Main Roads Western Australia

Tonkin Highway Grade Separated Interchanges, Hale Road and Welshpool Road

Action Management Plan

February 2021

GHD scope and limitations

Main Roads Western Australia (Main Roads) commissions GHD Pty Ltd (GHD) to develop the Preliminary Documentation for EPBC 2019/8529 Tonkin Highway Grade Separated Interchanges for submission to the Department of Agriculture, Water and the Environment. This Action Management Plan (AMP) forms part of that request for additional information.

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Glossary

Abbreviation/ Term	Definition
AMP	Action Management Plan
BWSCP TEC	Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community
CoE	Clean on Entry and/or Exit
Cth	Commonwealth
DBCA	Department of Biodiversity, Conservation and Attractions
DE	Development Envelope
Dieback free material	Material that has been hygienically extracted from a site that has been assessed by DBCA registered *Phytophthora* Dieback interpreter and determined to be uninfested (dieback free).
EPBC Act	Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*
EPBC Regulations	Commonwealth Environment Protection and Biodiversity Conservation Regulations 2000
FRTBC	Forest Red-tailed Black Cockatoo
GDV	Groundwater Dependent Vegetation
ha	hectare
km	kilometre
m	metre
Main Roads	Main Roads Western Australia
MNES	Matters of National Environmental Significance
SCP	Swan Coastal Plain
Suitably qualified person	A person who has professional qualifications and at least three years of relevant work experience surveying for the relevant MNES and who can give authoritative assessment, advice and analysis on performance relative to the subject matter using relevant protocols, standards, methods or literature. If the person does not have appropriate professional qualifications, the person must have at least five years of work experience related to the subject matter and can give an authoritative assessment, advice and analysis on performance relative to the subject matter using relevant protocols, standards, methods or literature.
TEC	Threatened Ecological Community
WA	Western Australia

WoNS	Weeds of National Significance

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Appendices

1. Declaration of Accuracy

I declare that to the best of my knowledge, all the information contained in, or accompanying this document is complete, current and correct. I am duly authorised to sign this declaration on behalf of the proponent/approval holder. I am aware that:

a. giving false or misleading information is a serious offence under section 137.1 of the Criminal Code Act 1995 (Cth)

b. section 137.2 of the Criminal Code Act 1995 (Cth) makes it an offence for a person to produce a document to another person in compliance or purported compliance with a law of the Commonwealth where the person knows that the document is false or misleading;

c. section 490 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading; and

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Signed: _____ **Date**: _____

Full name: Laura Zimmerman, Environment Officer

Organisation: Main Roads Western Australia

EPBC Referral Number: EPBC 2019/8529

Action Management Plan Title: Tonkin Highway Grade Separated Interchanges, Hale Road and Welshpool Road, Action Management Plan

2. Purpose and context

2.1 Purpose

This Action Management Plan (AMP) has been prepared as part of Preliminary Documentation to support assessment of the Tonkin Highway Grade Separated Interchanges, Wattle Grove, WA (EPBC 2019/8529, the Proposed Action) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Preliminary Documentation has been prepared in response to a request by Department of Agriculture, Water, and Environment (DAWE) on 5 December 2019, for additional information to inform the assessment of the relevant impacts of the Proposed Action to Matters of National Environmental Significance (MNES).

The structure and content of this AMP has been prepared in accordance with Attachment C of DAWE's request for additional information.

2.2 Location and nature of relevant action activities

Main Roads Western Australia (Main Roads) proposes to upgrade Tonkin Highway from south of Roe Highway to approximately 1 km north of Kelvin Road, within the City of Kalamunda (the Proposed Action). Figure 1 (Appendix A) presents the Proposed Action location and Development Envelope (DE). The DE comprises an area of approximately 51.5 ha and represents the preliminary impact footprint.

The Proposed Action includes:

- Construction and operation of a 4.2 km six lane dual carriageway from south of Roe Highway to approximately 1 km north of Kelvin Road
- Single fly-over (half diamond with North facing ramps) at the intersection with Hale Road
- Grade separated (egg-about) interchange at Welshpool Road
- PSP on eastern side of the Tonkin Highway for the full length and grade separation at interchanges
- Concrete footpath on side roads with link to the PSP
- Single span bridges for grade separation interchanges
- Installation of associated road infrastructure, such as lighting, noise and retaining walls, safety barriers, stopping bays and traffic monitoring devices, signs and landscaping
- Drainage basins, drains and other associated infrastructure.

2.3 Schedule of action phases

2.3.1 Pre-construction

On-ground pre-construction activities will include ongoing maintenance of the existing Tonkin Highway (as required) and investigations to inform the design of the Proposed Action. Investigations are likely to include survey pick up and geotechnical investigations that do not impact on native vegetation or Matters of National Environmental Significance (MNES).

Design of the Proposed Action will continue to be refined during the pre-construction phase in order to reduce the environmental impacts and improve safety and usability. Consequently the disturbance from the Proposed Action is expected to be less than is currently being assessed.

2.3.2 Construction

Construction of the Proposed Action is planned to commence in late 2021 with construction expected to be completed in 2024. Commencement of the Proposed Action is subject to approvals and refinement of the preferred design option.

Construction of the road will be undertaken using conventional earth-moving and paving equipment and construction techniques. The road formation will be built using both imported fill and cut-to-fill materials from the DE.

Laydown areas for road building material will be established by the Construction Contractor in consultation with Main Roads and Local Government Authorities.

Temporary groundwater dewatering may be required for construction of bridge piers, abutment footings and drainage structures. Construction water may be abstracted by bores in the superficial aquifer within the DE.

2.3.3 Operation

Traffic modelling of the Tonkin Highway intersections was used to inform the road and bridge design, with forecast volumes based on the Main Roads ultimate network planning which extends to 2041.

Tonkin Highway will operate as a controlled access highway (freeway standard), with access onto Tonkin Highway restricted to specific interchange locations. Traffic will generally be free flowing on the six lane dual carriageway (three lanes each direction). Tonkin Highway will be subject to normal routine, recurrent and periodic maintenance during operation of the highway. The maintenance operations will be confined to the road corridor and the road itself, typically including maintenance of vegetation, drainage, lighting, road markings, signs and the road pavement.

2.4 Protected Matters

2.4.1 Information on MNES

The DE comprises and lies adjacent to land that supports the following MNES:

- Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (BWSCP TEC) (Endangered)
- Black Cockatoo species:
  - Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) (Endangered)
  - Forest Red Tailed Black Cockatoo (FRTBC) (*Calyptorhynchus banksia naso*) (Vulnerable)
  - Baudin's Cockatoo (*Calyptorhynchus baudinii*) (Endangered)
- Wavy-Leaved Smokebush (*Conospermum undulatum*) (Vulnerable)
- Slender Andersonia (*Andersonia gracilis*) (Endangered)
- Summer Honeypot (*Banksia mimica*) (Vulnerable).

BWSCP TEC

The BWSCP TEC is a woodland vegetation community characterised by a prominent tree layer of *Banksia* species, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The TEC is restricted to Western Australia's Swan Coastal Plain (SCP) and adjacent areas including Dandaragan Plateau in the north and Darling Scarp in the

east. The TEC is biodiverse and provides habitat for threatened fauna and flora, including Black Cockatoos. Key threats include clearing and fragmentation, fire regime and climate change, invasive species and *Phytophthora* dieback (TSSC 2016).

Black Cockatoos

Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is a large Black Cockatoo with white markings. The species nests in hollows in live or dead trees including Jarrah, Flooded Gum and Marri (DSEWPaC 2012). Breeding occurs mainly from July to mid-December. The species feeds in the canopy and understorey including *Banksia* species, Marri, Jarrah and non-native Pine (DSEWPaC 2012). Key threats include loss of habitat due to clearing or degradation, competition for nests, and death due to vehicle strike (DPaW 2013).

FRTBC (*Calyptorhynchus banksia naso*) is a large Black Cockatoo with red markings. The species displays erratic breeding activity in the summer and winter, peaking from April to June and August to October. Breeding is primarily in hollows of large, mature Marri trees and to a lesser extent Jarrah, Blackbutt Bullich and Wandoo (Johnstone, Kirkby and Sarti 2013). The species is a canopy feeder, with a diet primarily consisting of seeds of Marri and Jarrah and, in recent times, the seeds of Cape Lilac (Johnstone, Kirkby and Sarti 2017). Key threats include forest habitat loss, nest shortage and competition for nest hollows (DEC 2008).

Baudin's Cockatoo (*Calyptorhynchus baudinii*) is a large Black Cockatoo with white markings, with a more slender beak than Carnaby's Cockatoo. The species nest in hollows of live or dead trees including Marri and Tuart. Breeding occurs from August to March in the eucalypt forests of the south west (DSEWPaC 2012). The species forages in Jarrah, Marri and proteaceous woodland and heath (DSEWPaC 2012). Key threats include forest habitat loss, nest shortage and competition for nest hollows (DEC 2008).

Threatened flora

Wavy-Leaved Smokebush (*Conospermum undulatum*) is a long-lived erect shrub growing 1.5-2 m tall with distinctive fibrous stems and hairless leaves (DEC 2009). The species produces white wholly flowers between August and October. The species occurs on sand and sandy clay soils, on flat or gently sloping sites between the Swan and Canning Rivers, and has been found in association with BWSCP TEC (DEC 2009). Key threats include clearing, habitat degradation, road and firebreak maintenance, inappropriate fire regimes and weeds (DEC 2009).

Slender Andersonia (*Andersonia gracilis*) is a slender shrub, growing to 50 cm tall with few, spreading branches. The species produces pink to pale mauve flowers from September to November (DEC 2006). The species prefers seasonally damp, black sandy clay flats near or on the margins of swamps. Key threats include inappropriate fire regimes, road and firebreak maintenance, degraded habitat, *Phytophthora* dieback and weeds (DEC 2006).

Summer Honeypot (*Banksia mimica*) is a prostrate shrub with underground stems and leaves up to 41 cm long. The species produces yellow flowers from December to February. The species grows on flat to gentle slopes in grey and white sand in open woodlands (DEWHA 2008). Key threats include clearing, *Phythophthora* dieback, and frequent fire, which can cause weed invasion and degradation of habitat (DEWHA 2008).

2.4.2 Location and baseline condition

Biological surveys

The location and baseline condition of MNES within the DE and on adjacent land has been determined through biological surveys as follows:

1. Environmental (Woodman) (2021) biological survey over a 193.64 ha Survey Area comprising the DE and surrounding land, including:
   - Detailed flora and vegetation survey in accordance with WA Environmental Protection Authority (EPA) guidance (EPA 2016a)
   - Level 1 terrestrial fauna survey in accordance with WA EPA guidance (EPA 2016b)
   - Targeted Black Cockatoo habitat assessment in accordance with EPBC Act referral guidelines (DSEWPaC 2012).
2. GHD (2020) in-fill survey of 0.73 ha to address gaps in flora, vegetation and Black Cockatoo habitat mapping in three small areas in the vicinity of the Tonkin Highway/Hale Road intersection. This provided complete coverage of the DE.
3. Glevan Consulting (2020) *Phytophthora* dieback occurrence assessment over the DE.
4. GHD (2021) targeted flora survey and black cockatoo hollow assessment over the DE. The hollow assessment addressed two trees identified by Woodman (2021) as containing hollows potentially suitable for nesting.

BWSCP TEC

Figure 2 (Appendix A) and Table 1 present the extent and baseline condition of patches of BWSCP TEC within the Survey Area and DE.

Black Cockatoos

Figure 3, Figure 4 and Figure 5 (Appendix A); and Table 2 and Table 3 present the extent and condition of Black Cockatoo breeding and foraging habitat within the DE. Black Cockatoo habitat is also located in native vegetation on land adjacent to the DE.

In summary, Proposed Action will cause direct impacts to the following Black Cockatoo habitat within the DE:

- Up to 141 potential breeding trees (> 500 mm Diameter at Breast Height) for Black Cockatoo species, none of which contain hollows suitable for nesting by Black Cockatoos
- Up to 18.7 ha of moderate to low quality (score 2-4 out of 6) foraging habitat for Carnaby's Cockatoo
- Up to 7.9 ha of moderate to high quality (score 5 out of 6) foraging habitat and 11.3 ha of low to moderate quality (score 2-4) foraging habitat for FRTBC and Baudin's Cockatoo (total 19.1 ha of foraging habitat)

Table 1 BWSCP TEC Patch Extent and Baseline Condition within and adjacent to the DE

Patch No.	Baseline Vegetation Condition - Area (ha)				Total extent of Patch (ha)	Patch area within DE (ha)	Patch area within Survey Area remaining outside of DE (ha)
	Excellent	Very Good	Good	Degraded			
1	–	1.39	–	–	1.39	0	1.39
2	7.41	6.09	0.18	0.12	13.80	1.19	12.61
3	0.17	0.68	0.87	0.43	2.15	2.15	0
4	1.46	–	0.15	–	1.61	0.43	1.18
5	4.34	–	–	–	4.34	0.22	4.12
6	1.10	0.07	0.02	–	1.18	0	1.18
7	3.15	0.31	–	–	3.46	0	3.46
TEC extent within Survey Area (ha)	**17.63**	**8.54**	**1.22**	**0.55**	**27.93**		**-**
TEC extent within DE (ha)	**0.97**	**1.34**	**1.21**	**0.47**		**3.99**	
TEC extent within Survey Area remaining outside of DE (ha)	**16.66**	**5.81**	**0.01**	**0.08**			**23.94**

Table 2 Black Cockatoo potential breeding trees within and adjacent to the DE

Tree species	Number of potential breeding trees within DE (DBH > 500)	Number of trees with suitable hollows	Number of suitable hollows
Marri	91	-	-
Jarrah	5	-	-
Flooded Gum	31	-	-
Coastal Blackbutt	7	-	-
Stag	8	-	-
Total	**141**	**0**	**0**

Table 3 Black Cockatoo foraging habitat within the DE

Habitat score / value	Carnaby's Cockatoo foraging habitat (ha)	Forest Red-tailed Black Cockatoo foraging habitat (ha)	Baudin's Cockatoo foraging habitat (ha)
5: Moderate to High	0.0	7.9	7.9
4: Moderate	15.0	6.4	6.4
3: Low to Moderate	1.9	2.7	2.7
2: Low	1.8	2.1	2.2
1: Negligible	2.8	2.4	2.4
0: Nil	30.0	30.0	30.0
Total	**51.5**	**51.5**	**51.5**

Threatened flora

Figure 6 (Appendix A) presents the extent of Wavy-Leaved Smokebush habitat and records of individuals within the Survey Area and DE. A total of 1114 individuals were recorded from 778 locations within the Survey Area, of which 62 individuals from 58 locations were recorded within the DE. Table 4 presents the extent and condition of Wavy-Leaved Smokebush habitat within the DE.

Figure 7 (Appendix A) presents the extent of Slender Andersonia habitat and records of individuals within the Survey Area and DE. A total of 34 individuals were recorded from 15 locations within the Survey Area, of which 11 individuals from ten locations were recorded within the DE. Table 5 presents the extent and condition of Slender Andersonia habitat within the DE.

Figure 8 (Appendix A) presents the extent of Summer Honeypot habitat and records of individuals within the Survey Area and DE. A total of 30 individuals were recorded from 19 locations within the Survey Area, of which three individuals from two locations were recorded within the DE. Table 6 presents the extent and condition of Summer Honeypot habitat within the DE.

Table 4 Wavy-Leaved Smokebush habitat within the DE

Vegetation type	Condition	Area within the DE (ha)
VT1: *Eucalyptus marginata* subsp. *marginata* (Jarrah), *Banksia menziesii* (Firewood Banksia) and *Allocasuarina fraseriana* (Sheok) low woodland.	Excellent	0.97
	Very Good	1.34
	Good	1.20
	Degraded	0.73
VT4: *Corymbia calophylla* (Marri), *Eucalyptus todtiana* (Coastal Blackbutt) and *Eucalyptus patens* (Yarri) low woodland.	Excellent	1.27
	Very Good	0.14
	Good	0.36
	Degraded	1.42
Total		**7.45**

Table 5 Slender Andersonia habitat within the DE

Vegetation type	Condition	Area within the DE (ha)
VT5: *Callitris pyramidalis* and *Adenanthos cygnorum* subsp. *cygnorum* tall open shrubland.	Excellent	0.69
	Very Good	0.53
	Good	0.36
Total		**1.58**

Table 6 Summer Honeypot habitat within the DE

Vegetation type	Condition	Area within the DE (ha)
VT4: *Corymbia calophylla* (Marri), *Eucalyptus todtiana* (Coastal Blackbutt) and *Eucalyptus patens* (Yarri) low woodland.	Excellent	1.27
	Very Good	0.14
	Good	0.36
	Degraded	1.42
Total		**3.20**

Significant weeds

Woodman (2021) recorded 68 introduced taxa in the biological survey, of which 32 were found within the DE. Four of the introduced taxa within the DE are Declared Pest weed species under the Western Australian *Biosecurity and Management Act 2007* and two are a Weed of National Significance (WoNS):

- **Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WoNS
- **Echium plantagineum (*Paterson's Curse) – Declared Pest
- **Moraea flaccida* (One-leaf Cape tulip) – Declared Pest
- **Opuntia stricta* (Common Prickly Pear) – Declared Pest and WoNS.

Figure 9 (Appendix A) presents the locations of Declared Pests and WoNS recorded within the Survey Area and DE.

Phytophthora dieback

Glevan Consulting (2020) identified areas of Dieback infestation within the DE between Hale Road and Welshpool Road intersections, as presented in Figure 10 (Appendix A). Adjacent land to the West and East of the DE, within Hartfield Park, was identified as likely infested and associated with wetland areas. Areas of uninfested land were identified within the DE, south of the Hale Road intersection.

2.4.3 Management objectives

This AMP has been prepared with the objective that impacts of the Proposed Action to MNES are acceptable, minimised and managed. It is a 'management-based' AMP to document management actions required during Proposed Action construction and operation. Management measures within this AMP are specific to the Proposed Action.

The following management targets have been identified:

1. Prevent unauthorised clearing of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE.
2. Prevent edge impacts into adjacent areas of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE.
3. Avoid injury or mortality to Black Cockatoos during construction.
4. Minimise injury or mortality to Black Cockatoos during road operation.

3. Performance standards

3.1 SMART performance standards

The DAWE request for additional information (Attachment C) identifies the application of 'SMART' (specific, measurable, achievable, relevant and time-bound) performance standards to be applied to AMPs.

SMART performance standards are intended to relate to measurable (numerical) values which can be applied to a Proposal (rather than qualitatively measured management/monitoring actions), and may include measurements such as 'threshold criteria', 'performance indicators', 'corrective actions' and 'completion criteria'.

Table 7 identifies the SMART performance standards related to the measurable impacts of the Proposed Action. These SMART performance standards complement the management actions and performance targets identified in Table 12, the monitoring actions identified in Table 15, and the corrective actions identified in Table 12.

The 'threshold criteria' and 'completion criteria' are considered to be achievable, with the risk potential of not achieving the proposed SMART performance standards captured by the risk assessment presented in Table 11.

As the proposed SMART performance standards for 'threshold criteria' and 'completion criteria' relate to physical measures which can be readily controlled through standard construction management processes, it is considered the proposed SMART performance standards have a low level of uncertainty, with additional margins for safety not required.

The SMART performance standards do not require detailed statistical analysis to determine if the 'threshold criteria' and 'completion criteria' have been met, nor require statistical power to detect change (for example, seasonal or climatic variability), nor control or reference sites (for comparative purposes).

Table 7 SMART performance standards

Threshold criteria	Performance indicators	Corrective actions	Completion criteria
Clearing of 3.99 ha of Banksia Woodlands of the Swan Coastal Plain TEC	Area (ha) of Banksia Woodland TEC cleared	Refer to Table 12, Section 5	Not more than 3.99 ha of Banksia Woodland TEC cleared
Clearing of 19.1 ha of foraging habitat (low quality or better) for FRTBC and Baudin's Cockatoo	Area (ha) of FRTBC and Baudins' Cockatoo foraging habitat cleared		Not more than 19.1 ha of foraging habitat (low quality or better) for FRTBC or Baudin's Cockatoo cleared
Clearing of 18.7 ha foraging habitat (low quality or better) for Carnaby's Cockatoo	Area (ha) of Carnaby's' Cockatoo foraging habitat cleared		Not more than 18.7 ha of foraging habitat (low quality or better) for Carnaby's Cockatoo cleared
Clearing of 141 trees with a DBH ≥ 500 mm	Number of trees with a DBH ≥ 500 mm which contain a potentially suitable nesting hollow(s) cleared		Not more than 141 large trees (DBH 500 mm)
No clearing of trees with potentially suitable nesting hollows	Trees which contain a potentially suitable nesting hollow(s) cleared		No trees which contain potentially suitable nesting hollows cleared
Clearing of 62 individuals of Wavy-Leaved Smokebush	Number of individuals of Wavy-Leaved Smokebush cleared		Not more than 62 individuals of Wavy-Leaved Smokebush cleared.
Clearing of 7.45 ha of suitable habitat for Wavy-Leaved Smokebush	Area (ha) of Wavy-Leaved Smokebush suitable habitat cleared		Not more than 7.45 ha of suitable habitat for Wavy-Leaved Smokebush cleared
Clearing of 11 individuals of Slender Andersonia	Number of individuals of Slender Andersonia cleared		Not more than 11 individuals of Slender Andersonia cleared.

Threshold criteria	Performance indicators	Corrective actions	Completion criteria
Clearing of three individuals of Summer Honeypot	Number of individuals of Summer Honeypot cleared		Not more than 3 individuals of Summer Honeypot cleared

4. Risk assessment

A risk assessment has been undertaken of the potential impacts identified for the Proposed Action construction and operational phases. The risk assessment adopts likelihood and consequence criteria and a risk matrix presented in Table 8, Table 9 and Table 10, consistent with the Action Management Plan Criteria (Attachment C to DAWE request for additional information).

Table 11 presents the risk assessment results, incorporating a summary of mitigation measures to generate a residual risk outcome for each identified risk. Details of mitigation measures including monitoring and corrective actions are presented in the Section 5.

Table 8 Likelihood criteria

Likelihood	Criteria
Highly likely	Is expected to occur during the construction/operation period
Likely	Will probably occur during the construction/operation period
Possible	Might occur during the construction/operation period
Unlikely	Could occur during construction/operation but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

Table 9 Consequence criteria

Consequence	Criteria
Minor	Minor environmental impact that can be reversed
Moderate	Isolated but substantial environmental impact that could be reversed with intensive efforts
High	Substantial environmental impact that could be reversed with intensive efforts
Major	Major loss of environmental value and real danger of continuing
Critical	Severe widespread loss of environmental value and irrecoverable environmental damage

Table 10 Risk ranking matrix

Likelihood	Consequence				
	Minor	Moderate	High	Major	Critical
Highly likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

Table 11 Risk assessment of Proposed Action to MNES

Management objective	Impact	Cause	Level of uncertainty	Summary of Mitigation	Residual risk		
					Likelihood	Consequence	Risk rating
Prevent unauthorised clearing of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE. **Achieve SMART performance standards** (Table 7, Section 3)	Direct impact causing loss exceeding SMART performance standards: • 3.99 ha of BWSCP TEC • 141 potential breeding trees for Black Cockatoo species, none of which contain hollows suitable for nesting • 18.7 ha of foraging habitat for Carnaby's Cockatoo • 19.1 ha of foraging habitat for FRTBC and Baudin's Cockatoo • 62 individuals of Wavy-Leaved Smokebush and 7.45 ha of suitable habitat • 11 individuals of Slender Andersonia • 3 individuals of Summer Honeypot.	Unauthorised clearing of native vegetation outside of DE. Presence of Coastal Blackbutt tree (ID 204) with hollows suitable for nesting, which has canopy / root zone extending within DE.	• The nature of potential impact is known and predictable based on surveys in land adjacent to the DE, undertaken in accordance with EPA and Commonwealth guidance • The scale of potential impacts is unpredictable as it relates to unauthorised clearing, however should it occur, it is only likely to be isolated and of a much smaller scale than authorised clearing.	• Identification and demarcation of vegetation to be retained within DE, including MNES where practicable and including root zone and canopy of Coastal Blackbutt tree (ID 204) extending within DE • Pre-construction inspection of clearing areas and retention areas to confirm demarcation in place • Induction of construction personnel on the presence and high value of MNES adjacent to the DE, and MNES to be retained within the DE • Daily inspection of clearing areas and retention areas during clearing stage • Temporary construction areas will be located in existing cleared areas, areas to be cleared for permanent works, or in areas devoid of MNES • Stop work and implement corrective actions in the event of exceeding SMART performance standards trigger criteria.	Unlikely	Moderate	Low
Prevent edge impacts into adjacent areas of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE.	Indirect impacts to condition of adjacent native vegetation including: • BWSCP TEC • Foraging and potential breeding habitat for Black Cockatoos • Individuals of Wavy-Leaved Smokebush • Individuals of Slender Andersonia • Individuals of Summer Honeypot.	Construction plant, equipment and soil movement introducing or spreading weeds and/or dieback to uninfested vegetation. Unauthorised site access introducing or spreading weeds and/or dieback to uninfested vegetation.	• The nature of potential impact is known and predictable based on identified weed and dieback infested areas and vulnerable vegetation in surveys undertaken in DE and adjacent land • The scale of potential impacts is unpredictable as it relates to weeds and dieback which may progressively spread from the DE boundary into adjacent vegetation, and some vegetation may be resistant to dieback expression as appears to be occurring in some areas in the DE.	• Declared Plants within the DE will be treated according to WA Government advice, with the aim of eradication where possible but as a minimum prevent off site movement • WoNS and environmental weeds within the DE will be treated according to Weeds Australia guidance with the aim of controlling off-site movement • Topsoil containing Declared Pests or WoNS will not be reused in landscaping or revegetation • All heavy plant and machinery will be inspected prior to entry at the work site and confirmed to be clean and free of vegetation and soil material • Dieback protectable areas will be identified and established within the DE and adjacent land to guide dieback hygiene practices including restrictions on equipment and vehicle movement, soil movement, and Clean on Entry and/or Exit (CoE).	Unlikely	High	Medium
		Construction dewatering causing groundwater drawdown	• The nature of the impact is known as Conservation Advice (TSSC 2016) states that the dominant Banksia species of the BWSCP TEC are vulnerable to impact from groundwater lowering. Other MNES present	• Identification and demarcation of potential groundwater dependent vegetation that may be affected by dewatering • Groundwater level monitoring and vegetation condition monitoring undertaken at all identified	Unlikely	Moderate	Low

Management objective	Impact	Cause	Level of uncertainty	Summary of Mitigation	Residual risk		
					Likelihood	Consequence	Risk rating
		affecting groundwater dependent vegetation.	within the DE are not known to be vulnerable to groundwater drawdown, including the threatened flora, Jarrah and Marri • Subject to final design, the scale of the groundwater drawdown is expected to be localised to the vicinity of the DE at the Hale Road and Welshpool Road intersections for proposed foundation construction, and temporary for the period of dewatering required (8 weeks approximately) • Due to clayey soils in the area, depth and radius of drawdown is expected to be limited. Dewatering at Hale Road and Welshpool Road will be far enough apart to avoid intersecting cones of depression; therefore, drawdown in the aquifer is minimised.	areas of potentially affected groundwater dependent vegetation, to identify any early impacts of dewatering • If groundwater dependent vegetation are exhibiting signs of impact from dewatering, remedial measures (e.g. infiltration trenches, diaphragm walls) will be implemented to restore groundwater levels to pre-construction levels.			
		Surface water runoff and spills from temporary construction areas causing erosion, sedimentation or contamination.	• The nature of the impact is known as construction will involve ground disturbance, generation of wastes and use of hazardous materials (e.g. diesel fuel), and will occur adjacent to BWSCP TEC, Black Cockatoo habitat and habitat for threatened flora species • The scale of the impact is unpredictable as it relates to major storm or spill events, however it is expected to be localised to land in the vicinity of the DE.	• Temporary erosion and sediment controls will be maintained within the DE during construction to prevent stormwater runoff from construction areas from eroding or causing sediment deposition in adjacent native vegetation • Waste and hazardous materials management measures will be implemented in construction to prevent contaminant discharges to adjacent native vegetation. • No storage of waste or hazardous materials within 50 m of BWSCP TEC, Black Cockatoo habitat or habitat for threatened flora.	Unlikely	Moderate	Low
		Surface water runoff from road surface causing erosion, sedimentation or contamination.	• The nature of the impact is known as the DE will comprise upgraded carriageways and intersections that will generate stormwater runoff, and lie adjacent to BWSCP TEC, Black Cockatoo habitat and habitat for threatened flora species • The scale of the impact is unpredictable as it relates to major storm or spill events, however it is expected to be localised to land in the vicinity of the DE.	• Surface runoff within the DE will drain into infiltration basins and/or swales constructed within the DE. The infiltration basins/swales will be designed to capture and infiltrate runoff from a 1 in 100 year Average Recurrence Interval rainfall event, to prevent stormwater runoff into adjacent areas of native vegetation. The infiltration basins/swales will be planted with native vegetation to assist with nutrient stripping of stormwater during infiltration.	Rare	Moderate	Low
Avoid injury or mortality to Black Cockatoos during construction.	Injury or mortality to Black Cockatoo individuals.	Vehicle collision with birds during construction.	• The nature of the impact is known, as the DE contains and lies adjacent to Black Cockatoo habitat, and Black Cockatoos	• Speed limits between 40-60 km/hr will be applied throughout the construction site for safety purposes which will consequently reduce the risk of fauna strikes during construction	Unlikely	Moderate	Low

Management objective	Impact	Cause	Level of uncertainty	Summary of Mitigation	Residual risk		
					Likelihood	Consequence	Risk rating
			have been known to be killed through vehicle strike • The scale of the impact is unpredictable as it relates to unplanned events and bird/flock behaviour. Collisions are expected to impact individuals or small numbers of birds, however the number of collisions is unpredictable.	• A list of local wildlife rescue organisations and carers will be maintained on site to contact in the event of fauna injury • Induction of construction personnel on reducing the risk of fauna injury and the procedure in the event of fauna injury or death.			
		Clearing of active breeding trees.	• The nature of the impact is known, as the DE lies adjacent to one tree with hollows suitable for Black Cockatoo nesting that could potentially be used during construction, however the tree does not have breeding records and is not expected to be utilised for breeding during construction • The scale of the impact is unpredictable as it is uncertain whether breeding will be occurring during construction, however it is considered unlikely given the lack of breeding records in the vicinity.	• Within 7 days prior to clearing, trees with hollows used by or suitable for use by Black Cockatoos will be inspected by a suitably qualified person to confirm that there are no hollows being used by Black Cockatoos within the area to be cleared.	Rare	Moderate	Low
Minimise injury or mortality to Black Cockatoos during road operation.	Injury or mortality to Black Cockatoo individuals.	Vehicle collision with birds during operations (additional impact above and beyond existing road).	• The nature of the impact is known, as the DE lies adjacent to Black Cockatoo habitat and Black Cockatoos have been known to be killed through vehicle strike • The scale of the impact is unpredictable as it relates to unplanned events and bird/flock behaviour. Collisions are expected to impact individuals or small numbers of birds, however the frequency of collisions is unpredictable.	• Where trees that are known to be Black Cockatoo habitat are retained within the DE but are located within 10 m of the edge of the road seal the risk of fauna strike will be assessed to determine if wildlife hazard signage is required • Revegetation within the DE that is within 10 m of the road seal will not be planted with Black Cockatoo foraging species.	Unlikely	Moderate	Low

5. Environmental management actions

In order to comply with relevant environmental legislation and manage impacts to the local environment, Main Roads has defined objectives, outcomes and management based provisions to ensure that impacts to MNES are avoided and minimised as far as practicable during the implementation of the Proposed Action (Table 12).

Table 12 Management measures to mitigate construction impacts to MNES

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
Prevent unauthorised clearing of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE. **Achieve SMART performance standards** (Table 7, Section 3)	All currently identified Black Cockatoo potential breeding trees or threatened flora individuals within the construction site boundary that are not required to be cleared will be marked and identified as no-go areas, demarcated on relevant drawings and provided to the Construction Contractor Representative. Coastal Blackbutt tree (ID 204) root zone / canopy will be identified by a suitably qualified professional and demarcated on relevant drawings and provided to the Construction Contractor Representative.	Drawings showing environmental no-go areas provided to the Construction Contractor Representative.	Contract award and prior to commencement of clearing.	Record of provision of drawings showing environmental no-go areas.	Clearing more than: • 3.99 ha of BWSCP TEC • 141 potential breeding trees for Black Cockatoo species, none of which contain hollows suitable for nesting • 18.7 ha of foraging habitat for Carnaby's Cockatoo • 19.1 ha of foraging habitat for FRTBC and Baudin's Cockatoo • 62 individuals of Wavy-Leaved Smokebush • 7.45 ha of suitable habitat for Wavy-Leaved Smokebush • 11 individuals of Slender Andersonia • 3 individuals of Summer Honeypot. Clearing within the root zone / canopy of Coastal Blackbutt tree ID 204.	• Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until no-go areas have been reviewed and confirmed to be in place correctly, and Main Roads Superintendent provides approval to recommence • In the event of suspected root or canopy damage to Coastal Blackbutt tree (ID 204), practicable remedial treatments will be provided to maintain the tree's health, in accordance with the advice of a suitably qualified professional • Environmental incident will be recorded and the cause investigated • Incident will be reported to DAWE along with the cause identified from an investigation • Incorrectly cleared areas will be assessed for potential remediation (in consultation with DAWE). Areas for remediation will be included in the Landscape and Revegetation Plan for the project within 6 months of completion of clearing for revegetation with BWSCP TEC, Black Cockatoo foraging habitat species and threatened flora species/habitat • Refresher or updated training will be conducted (if appropriate).	• Construction Contractor Environmental Management Representative • Main Roads Superintendent .
	Vegetation to be retained will be clearly marked with flagging on site.	All vegetation to be retained will be marked with flagging on site.	Prior to commencement of clearing.	• Incident reporting (EQSafe) • Monthly site inspections • Site inspection by Construction Contractor Environmental Management Representative prior to and following clearing to confirm no-go areas are appropriately flagged / fenced, and that clearing remains within limits.			
	All clearing areas will be marked with flagging and approved by the Main Roads Superintendent prior to clearing commencing.	All areas to be cleared will be marked with flagging on site.					
	• Additional areas required for construction such as laydown areas, stockpile areas and vehicle turn around, will be located in areas cleared for permanent works or areas that do not contain BWSCP TEC, Black Cockatoo habitat, or threatened flora habitat • Clearing will be avoided for any temporary construction activities.	Areas for ancillary services located in cleared areas or areas that do not contain or lie adjacent to BWSCP TEC, Black Cockatoo habitat, or threatened flora or habitat.	During construction.	• Construction site plan showing all ancillary areas not located on land containing or adjacent to BWSCP TEC, Black Cockatoo habitat or threatened flora habitat • Monthly site inspections.	Areas required for construction such as laydown areas etc are proposed to be located within areas devoid of native vegetation.	• Main Roads Superintendent is required to provide approval for clearing of native vegetation for construction laydown etc. and approval must only be given if there are no other practicable options • Incorrectly cleared areas will be assessed for potential remediation (in consultation with DAWE). Areas for remediation will be included in the Landscape and Revegetation Plan for the project within 6 months of	Main Roads Superintendent

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
						completion of clearing for revegetation with BWSCP TEC, Black Cockatoo foraging habitat species and threatened flora species/habitat.	
Prevent edge impacts into adjacent areas of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE.	Declared Plants within the construction site boundary will be treated according to their Control Codes and advice from Department of Primary Industries and Regional Development (DPIRD), with the aim of eradication where possible but as a minimum prevent off site movement.	No new occurrence or spread of Declared Plants within the construction site boundary or immediately adjacent areas during construction activities.	All construction activities	• Monthly site inspections • Annual revegetation monitoring.	New occurrence or spread of a Declared Plant identified	• Application of weed eradication techniques for the weed species • Review CoE process.	Construction Contractor Environmental Management Representative
	WoNS and environmental weeds within the construction site boundary will be treated according to the weed control management outlined by Weeds Australia (http://weeds.ala.org.au/) with the aim of controlling off-site movement.	No new occurrence or spread of WoNS or environmental weeds through construction activities.			New occurrence or spread of a WoNS or environmental weed identified	• Application of weed eradication techniques for the weed species until completion criteria of weed cover at less than 30% is met • Review CoE process.	
	Topsoil containing Declared Pests or WoNS will not be reused in landscaping or revegetation.	All topsoil from Declared Pest or WoNS infested areas to be buried at a depth of at least 300 mm or disposed off-site at a landfill.	During construction	Records of topsoil segregation and burial or licensed waste facilities	Topsoil from infested areas used in landscaping or revegetation	• Topsoil removed from landscaping/revegetation areas and replaced with clean topsoil. Infested topsoil buried at depth of at least 300 mm or disposed at a licensed waste facility.	
	All heavy plant and machinery will be inspected by the contractor prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material.	All plant and machinery will be verified clean on arrival at site.	All construction activities	Records verifying plant and machinery arriving on site is clean	Plant and machinery arriving on site without verification that it is clean of soil and vegetative matter	• Refresher training will be conducted • Plant and machinery sent off site and cleaned prior to re-entry to site.	
	Dieback protectable areas within and adjacent to the DE will be identified, mapped, established and managed in accordance with DBCA Management Guidelines (CALM 2003) including: • Entry points into or adjacent to protectable areas will be minimised and limited to one entry point if practicable • CoE points will be established for all access into or adjacent to protectable areas • CoE points will be clearly demarcated and have sufficient turnaround for vehicles and equipment if failing inspection	Dieback protectable areas marked with flagging on site. CoE points established and signposted. Temporary construction drainage established.	Prior to commencement of site disturbance.	• Monthly site inspections • Site inspection by Construction Contractor Environmental Management Representative to confirm protectable areas are appropriately flagged, CoE points established and signposted.	Uncontrolled access into protectable areas. Construction site drainage from infested areas discharging into protectable areas.	• Environmental incident will be recorded and the cause investigated • Potentially infested areas arising from access or drainage will be sampled for *Phytophthora* • Phosphite will be applied to dieback susceptible species within 30 m of potentially infested areas, in accordance with DBCA guidance. • Review CoE process. • Refresher or updated training will be conducted (if appropriate).	

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
	• Construction site drainage arising from known or potential infested areas will be directed away from protectable areas.						
	Dieback free basic raw materials and revegetation nursery stock to be used within or adjacent to protectable areas.	All basic raw materials and nursey stock used within or adjacent to protectable areas verified as dieback free.	During construction and revegetation.	Dieback free verification records.	Un-verified material placed in or adjacent to protectable area.	• Environmental incident will be recorded and the cause investigated • Un-verified material will be sampled for *Phytophthora* at sampling density according to WA contaminated site guidelines • If un-verified material is found to contain Phytophthora, the material will be removed and placed in an infected area of a licensed waste facility • Phosphite will be applied to dieback susceptible species within 30 m of placed material that tested positive for Phytophthora, in accordance with DBCA guidance • Review material/nursery stock supplier arrangements.	
	Topsoil from infected or potentially infected *Phytophthora* dieback areas will be segregated and not used in non-infected areas.	All topsoil from infested and potentially infected dieback areas used in infected areas or disposed of at a licensed facility.	During construction.	Records of topsoil segregation and reuse from infected areas or licensed waste facilities.	Topsoil from infected or potentially infected dieback areas used in non-infected areas.	• Topsoil sampled for *Phytophthora* at sampling density according to WA contaminated site guidelines • If topsoil found to contain *Phytophthora*, the topsoil will be removed and placed on an infected area or a licensed waste facility • Phosphite will be applied to dieback susceptible species within 30 m of placed topsoil that tested positive for *Phytophthora*, in accordance with DBCA guidance.	
	CoE procedures will be implemented on site, and entry and exit records kept for CoE points.	No breach of CoE protocols.	For the duration of the approval.	• Entry and/or exit records for CoE points • Monthly site inspections.	Breach of CoE protocol.	• Refresher training will be conducted.	
	If construction dewatering is required, groundwater modelling will be undertaken to estimate the cone of depression and identify	No visible signs of impact to potential GDV due to construction dewatering.	During dewatering.	• Groundwater modelling and GDV report/mapping	Potential GDV are exhibiting signs of impact from dewatering.	If potential GDV are exhibiting signs of impact from dewatering, remedial measures (e.g. infiltration trenches,	Construction Contractor Environmental

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
	potential groundwater dependent vegetation (GDV) that may be impacted, which will be monitored and managed to prevent impacts.			• Groundwater level monitoring and vegetation condition monitoring undertaken at all identified areas of potentially affected GDV.		diaphragm walls) will be implemented to restore groundwater levels to pre-construction levels.	Management Representative
	Temporary drainage structures within or adjacent to BWSCP TEC, Black Cockatoo habitat or threatened flora habitat will be designed and constructed such that scouring or erosion within adjacent vegetated areas does not occur.	No evidence of erosion from construction activities within no-go areas or BWSCP TEC, Black Cockatoo habitat or threatened flora habitat to be retained.	Prior to and during construction.	Monthly site inspections.	Erosion identified in BWSCP TEC, Black Cockatoo habitat or threatened flora habitat be retained.	• Review drainage to identify whether there are any failure points, and repair/address any failure points identified within 2 weeks.	Construction Contractor Environmental Management Representative
	Topsoil within the DE will be harvested, stockpiled and reused in accordance with Main Roads Environmental Guideline Topsoil Management.	Topsoil is managed in accordance with Main Roads Guideline.	Prior to and during construction and landscaping.	Monthly site inspections.	Topsoil is not managed in accordance with Main Roads Guideline.	• Topsoil management amended to ensure compliance with Main Roads Guideline.	Construction Contractor Environmental Management Representative
	Landscaping within the road reserve will use local native species in accordance with Main Roads Specification 304 (Revegetation and Landscaping) and Main Roads Environmental Guideline Revegetation Planning and Techniques.	Landscaping is compliant with Main Roads Specification 304 and Guideline.	Prior to and during landscaping.	• Review of landscaping plans and species list • Inspection of landscaping areas.	• Landscaping plans and species lists are not compliant • Landscaping works do not comply with approved plans and species list.	• Landscaping plans and species list amended to ensure compliance • Landscaping works are re-planted to comply with approved plans and species list.	• Construction Contractor Environmental Management Representative • Main Roads Superintendent
Avoid injury or mortality to Black Cockatoos during construction.	Speed limits between 40-60 km p/hr will be applied throughout the construction site for safety purposes which will consequently reduce the risk of fauna strikes during construction.	No incidents of speeding within the construction site boundary.	During construction.	• Visual monitoring by all construction personnel • Incident reporting (EQSafe).	Reported exceedance of site speed limits.	• Refresher training will be conducted within 1 week • Instances of speeding are identified and offenders will be asked to immediately reduce speed • Repeat offenders (ie. Caught speeding more than 2 times) will undergo further refresher training.	Construction Contractor Environmental Management Representative
	A list of local wildlife rescue organisations and carers will be maintained on site to contact in the event of fauna injury.	A list of local wildlife rescue organisations and carers is on site at all times.		• Monthly inspection.	• A list of local wildlife rescue organizations and carers is not on site • Wildlife rescue specialists not contacted immediately on discovery of an injured Black Cockatoo.	• A list of local wildlife rescue organizations and carers is obtained by site immediately • Refresher training will be conducted within 1 week.	

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
	Within 7 days prior to clearing, trees with hollows suitable for use by Black Cockatoos will be inspected by a suitably qualified person to confirm that there are no hollows being used by Black Cockatoos within the area to be cleared.	Survey of trees with hollows suitable for use by Black Cockatoos will be undertaken within 7 days prior to clearing events.	Within 7 days prior to clearing events.	• Survey of hollows that are suitable for use by Black Cockatoos • Maintain a register of nesting trees.	Clearing event undertaken without pre-clearing survey.	• Contractor to provide evidence that a suitably qualified person is engaged to conduct surveys prior to subsequent clearing events • Contractor to provide evidence that surveys are scheduled within 7 days prior to subsequent clearing events.	Construction Contractor Environmental Management Representative
					Survey undertaken more than 7 days prior to clearing.	• Unanticipated clearing event delays will be risk assessed against survey findings • Clearing in the direct vicinity will cease immediately if trigger is met • Clearing will not recommence until nogo areas have been reviewed and confirmed to be in place correctly, and Main Roads Superintendent provides approval to recommence.	
	Any tree and vegetation within 10m of the tree identified as being used by Black Cockatoos for nesting must not be cleared until a suitably qualified person has verified that the tree is not in use.	• No clearing of trees used by Black Cockatoo • All trees currently being used by Black Cockatoos are marked with flagging as no-go areas with flagging with a 10 m exclusion zone • All hollows being utilised by the species are detected during surveys • No Black Cockatoo mortality or injury during clearing.	Black Cockatoo breeding season and following survey of area to be cleared.	• Surveys undertaken by suitably qualified person to confirm hollow is no longer being used by Black Cockatoo • Maintain a register of nesting trees.	• Clearing of a tree with a hollow currently used by Black Cockatoo • Suitably qualified person has not confirmed the tree is no longer being utilised by Black Cockatoos before it is cleared.	• Immediate inspection of felled tree (eg with hollow currently in use) to determine survivability of Black Cockatoo (if present) • A list of local wildlife rescue organisations and carers will be maintained on site. This will allow efficient identification of an appropriate destination to which to transfer injured cockatoo • Incorrectly cleared areas will be included in the Landscape and Revegetation Plan for the project for revegetation with Black Cockatoo foraging habitat species • Clearing activities are immediately ceased in the vicinity of the unmarked trees and relevant trees are correctly flagged before clearing activities recommence • If a tree currently utilised by the species is felled, clearing in the direct vicinity will cease immediately if trigger is met • Clearing will not recommence until nogo areas have been reviewed and confirmed to be in place correctly, and	• Construction Contractor Environmental Management Representative • Main Roads Superintendent.

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
						Main Roads Superintendent provides approval to recommence.	
Avoid injury or mortality to Black Cockatoos during road operation.	Revegetation designs shall not include foraging or breeding plant species within 10 m of the road.	• Landscaping designs exclude foraging or breeding plant species within 10 m of the road.	Prior to commencement of revegetation.	• Landscape design drawings showing location of revegetation, and summarising plant species mix.	• Landscape designs include foraging or breeding plant species within 10 m of the road • Foraging or breeding plant species planted within 10 m of the road.	• Design drawings amended to exclude revegetation with foraging or breeding plant species within 10 m of the road • Foraging or breeding plant species removed from within 10 of the road and replaced with non-habitat species.	• Construction Contractor Environmental Management Representative • Main Roads Superintendent .
	Where trees that are known to be Black Cockatoo habitat are retained but are located within 10 m of the edge of the road seal the risk of fauna strike will be assessed to determine if wildlife hazard signage is required.	• Black Cockatoo habitat retained within 10 m of the edge of the seal of the road will be risk assessed and wildlife hazard signage installed as required.	Prior to completion of construction.	• Risk assessment.	• Black Cockatoo habitat is retained within 10m of the edge of the road seal and is not risk assessed to determine whether wildlife hazard signage is required.	• Risk assess retained Black Cockatoo habitat within 10 m of the edge of the road seal and install wildlife hazard signage if required.	Construction Contractor Environmental Management Representative

6. Adaptive management

This AMP adopts an 'adaptive management' approach which seeks to embed a cycle of monitoring, reporting and implementing change, where required. Accordingly, it is intended that this AMP may be updated (as required) over the life of the Proposed Action to reflect changes in the monitoring and management practices, subject to the results of the monitoring to identify that the environmental objectives are being achieved. The AMP may also be revised to address learnings from the implementation of corrective actions, should this occur.

In addition, auditing and review schedules are necessary to embed a formal process to identify and consider any need to update the AMP in order to achieve improved environmental performance (which may not otherwise be triggered by management or monitoring outcomes).

6.1 Environmental auditing

This AMP will be audited annually by Main Roads during construction for the Proposed Action to ensure the implementation of the management and monitoring measures, and to confirm the management measures specified are achieving the environmental outcomes.

The proposed auditing schedule for this AMP is identified in Table 13.

Table 13 Environmental audit schedule

Timing	Action	Schedule
Pre-construction	Review of construction procedures to ensure AMP management / monitoring actions are incorporated within works procedures	Prior to construction (single event)
Construction	Inspections by site environmental personnel to identify compliance with AMP	Periodic (monthly)
	Independent 'third-party' audit for assessment of compliance with AMP	Annually (once per calendar year)
Post construction	Independent 'third-party' audit for assessment of compliance with AMP	Annually (once per calendar year for up to three years)

The results of the construction and post construction independent 'third-party' audit findings will be reported to DAWE as part of annual compliance reporting as outlined within Section 8.

6.2 Management review program

Main Roads proposes to review this AMP annually in order to consider:

- Management and monitoring actions
- Opportunities for improvement in environmental performance (for example, changes to construction methodology or timing)
- Identify a need to update this AMP to capture changes to the management and/or monitoring actions
- Identify any general need to update this AMP (for example, to capture new information on relevant MNES knowledge or management, or updates to the EPBC Act or Policy Statements).

Main Roads acknowledge that a revision to this AMP may trigger a need for additional approval by DAWE prior to implementing any changes to the specified management or monitoring actions.

The proposed AMP review schedule for the Proposed Action is identified in Table 14. The proposed review will be undertaken by a suitably qualified ecologist or relevant expert.

Table 14 AMP Review schedule

Timing	Action	Schedule
Pre-construction Construction Post construction (up to three calendar years from completion)	Review of AMP management and monitoring actions Review of opportunities for an improvement in environmental performance Address learnings from corrective actions Revise AMP (if appropriate) and seek approval of DAWE for revised AMP	Annually (once per calendar year)

7. Monitoring program and Data management

7.1 Monitoring program

Key monitoring actions have been identified to monitor the potential impacts of the Proposed Action to MNES and habitat during and post construction. These encompass monitoring of both direct and indirect impacts of the Proposed Action. Monitoring will be undertaken by suitably qualified individuals for the methodology type specified. The proposed monitoring program for the Proposed Action is identified in Table 15.

7.2 Data management

Main Roads will maintain records on the implementation of this AMP in accordance with Main Roads' corporate standard document control procedures. The retention of records held by Main Roads will be maintained and managed in accordance with the Western Australian State Records Act 2000 (WA).

7.3 Baseline data

Appendix A presents baseline data of relevant MNES extent and condition, developed from on-ground surveys, namely:

- Figure 2 Banksia Woodland of the Swan Coastal Plain TEC
- Figure 3 Carnabys Cockatoo habitat
- Figure 4 Forest Red-tailed Black Cockatoo habitat
- Figure 5 Baudin's Cockatoo habitat
- Figure 6 Wavy-Leaved Smokebush records and habitat
- Figure 7 Slender Andersonia records and habitat
- Figure 8 Summer Honeypot records and habitat
- Figure 9 Significant weeds and vegetation condition
- Figure 10 *Phytophthora* dieback occurrence.

Table 15 Proposed monitoring program

Management Objective / Desired Outcome	Performance Target/Completion Criteria	Monitoring/Reporting Activity	Monitoring Method	Monitoring Area	Frequency
Prevent unauthorised clearing of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE. **Achieve SMART performance standards** (Table 7, Section 3).	Drawings showing environmental no-go areas provided to the Construction Contractor Representative.	Record of provision of drawings showing environmental no-go areas.	Review of written records	n/a	Prior to commencement of clearing
	All environmental no-go areas clearly marked with flagging on site. All vegetation to be retained will be marked with flagging on site. All areas to be cleared will be marked with flagging on site.	• Incident reporting (EQSafe) • Monthly site inspections • Site inspection by Construction Contractor Environmental Management Representative prior to and following clearing to confirm no-go areas are appropriately flagged / fenced, and that clearing remains within limits.	Visual inspection, pedestrian walk through Photographic record, GPS of non-conformance	Environmental no-go areas	Prior to commencement of clearing Monthly
	Areas for ancillary services located in cleared areas or areas that do not contain BWSCP TEC, Black Cockatoo habitat, or threatened flora or habitat.	• Construction site plan and photos showing all ancillary areas not located on land containing BWSCP TEC, Black Cockatoo habitat or threatened flora habitat • Monthly site inspections.	Written record Visual inspection, pedestrian walkthrough Photographic record, GPS of non-conformance	n/a Ancillary service areas	Prior to development of ancillary areas Monthly

Management Objective / Desired Outcome	Performance Target/Completion Criteria	Monitoring/Reporting Activity	Monitoring Method	Monitoring Area	Frequency
Prevent edge impacts into adjacent areas of BWSCP TEC, Black Cockatoo habitat and threatened flora individuals or habitat outside the DE.	No new occurrence or spread of Declared Plants within the construction site boundary or immediately adjacent areas during construction activities.	• Monthly site inspections • Annual revegetation Representative monitoring.	Visual inspection, pedestrian walkthrough Photographic record, GPS of non-conformance	Construction site area Construction site boundary	Monthly
	No new occurrence or spread of WoNS or environmental weeds through construction activities.				
	All topsoil from Declared Pest or WoNS infested areas to be buried at a depth of at least 300 mm or disposed off-site at a landfill.	Records of topsoil segregation and burial or licensed waste facilities.	Review of written records	n/a	Monthly
	All plant and machinery will be verified clean on arrival at site.	Records verifying plant and machinery arriving on site is clean.	Written records	n/a	n/a
	Dieback protectable areas marked with flagging on site. CoE points established and signposted. Temporary construction drainage established.	• Monthly site inspections • Site inspection by Construction Contractor Environmental Management Representative to confirm protectable areas are appropriately flagged, CoE points established and signposted.	Visual inspection, pedestrian walkthrough Photographic record, GPS of non-conformance	Dieback protectable areas	Prior to commencement of site disturbance Monthly

Management Objective / Desired Outcome	Performance Target/Completion Criteria	Monitoring/Reporting Activity	Monitoring Method	Monitoring Area	Frequency
	All basic raw materials and nursey stock used within or adjacent to protectable areas verified as dieback-free.	Dieback free verification records.	Review of written records	n/a	Monthly
	All topsoil from infested and potentially infected dieback areas used in infected areas or disposed of at a licensed facility.	Records of topsoil segregation and reuse from infected areas or licensed waste facilities.	Review of written records	n/a	Monthly
	No breach of CoE protocols.	• Entry and/or exit records for CoE points • Monthly site inspections.	Visual inspection, pedestrian walkthrough Photographic record, GPS of non-conformance	CoE points	• Monthly
	No visible signs of impact to potential GDV due to construction dewatering.	• Groundwater modelling and GDV report/mapping • Groundwater level monitoring and vegetation condition monitoring undertaken at all identified areas of potentially affected GDV	Review of written record Groundwater bore upgradient at boundary of GDV Visual inspection by qualified botanist, photographic record and GPS of condition assessment	n/a Identified areas of potentially affected GDV	Prior to dewatering Weekly GWL measurement Weekly inspection of GDV
	No evidence of erosion from construction activities within no-go areas or BWSCP TEC, Black	Monthly site inspections.	Visual inspection, pedestrian walkthrough	Environmental no-go areas	Monthly After major storm

Management Objective / Desired Outcome	Performance Target/Completion Criteria	Monitoring/Reporting Activity	Monitoring Method	Monitoring Area	Frequency
	Cockatoo habitat or threatened flora habitat to be retained.		Photographic record, GPS of non-conformance		event (> 1 in 1 year Average Recurrence Internal)
	Topsoil is managed in accordance with Main Roads Guideline.	Monthly site inspections.	Visual inspection, pedestrian walkthrough Photographic record, GPS of non-conformance	Topsoil stockpiles Revegetation areas	Monthly
	Landscaping is compliant with Main Roads Specification 304 and Guideline.	• Review of landscaping plans and species list • Inspection of landscaping areas.	Review of written record Visual inspection, pedestrian walkthrough Photographic record, GPS of non-conformance	n/a Revegetation areas	Prior to commencement of landscaping After planting
Avoid injury or mortality to Black Cockatoos during construction.	No incidents of speeding within the construction site boundary.	• Visual monitoring by all construction personnel Incident reporting (EQSafe).	Visual inspection, pedestrian walkthrough	Construction site	Opportunistic
	A list of local wildlife rescue organisations and carers is on site at all times.	• Monthly inspection	Written record	n/a	n/a
	Survey of trees with hollows used by or suitable for use by Black Cockatoo undertaken within 7 days prior to clearing events.	Survey for hollows that are being used, or are capable of being used, by Black Cockatoos	Survey undertaken by suitably qualified person, using pole camera or drone	Individual trees with hollows suitable for nesting	Within 7 days of clearing

Management Objective / Desired Outcome	Performance Target/Completion Criteria	Monitoring/Reporting Activity	Monitoring Method	Monitoring Area	Frequency
		Maintain a register of nesting trees	Review of written records	n/a	Monthly
	• No clearing of trees used by Black Cockatoo • All trees currently being used by Black Cockatoos are marked with flagging as no-go areas with flagging with a 10 m exclusion zone • All hollows being utilised by the species are detected during surveys • No Black Cockatoo mortality or injury during clearing.	• Surveys undertaken by suitably qualified person to confirm hollow is no longer being used by Black Cockatoo • Maintain a register of nesting trees.	Survey undertaken by suitably qualified person, using pole camera or drone Written record	Individual trees with hollows suitable for nesting	Weekly when nest is in use
Avoid injury or mortality to Black Cockatoos during road operation.	• Revegetation designs exclude foraging or breeding plant species within 10 m of the road.	• Record of revegetation drawings showing species mix.	Review of written record	n/a	Prior to revegetation commencing
	• Black Cockatoo habitat retained within 10 m of the edge of the seal of the road will be risk assessed and wildlife hazard signage installed as required.	• Risk assessment.	Review of written record	n/a	n/a

8. Reporting

Main Roads will report to DAWE on the implementation of this AMP as part of annual compliance reporting under the conditions of approval for the Proposed Action.

Where compliance audits undertaken by Main Roads identify that the environmental management actions and/or the environmental objectives are not being achieved (i.e. non-compliance or an environmental incident), Main Roads will notify DAWE as soon as reasonably practicable. Consistent with standard document control procedures, Main Roads will maintain copies of all reports submitted to DAWE. The reporting requirements for this AMP are identified in Table 16.

Table 16 Reporting requirements

Aspect	Report from	Report to	Reporting Frequency
Implementation of AMP	Manager Environment	DAWE	Annually (as part of annual compliance reporting)
Non-compliance with AMP or Environmental Incident	Manager Environment	DAWE	As soon as reasonably practicable but not more than seven days

The format and content of annual reporting will be in accordance with the requirements of the annual reporting conditions. The format and content of reporting of a non-compliance event or an environmental incident will be subject to the nature of the non-compliance/incident and will include all requested information from DAWE. In consideration of this, specific templates for reporting these are not provided as part of this AMP.

9. Roles and Responsibilities

This AMP identifies the environmental management of activities to be undertaken by Main Roads in implementation of the Proposed Action. Main Roads acknowledges that the environmental management actions contained within this AMP are legal requirements to be met.

The Manager Environment at Main Roads will maintain responsibility for implementation of the management actions outlined within this AMP, on behalf of Main Roads' Managing Director. Management actions may be undertaken by employees and/or contractors of Main Roads on behalf of Managing Director.

Where management actions are undertaken by employees and/or contractors of Main Roads, these will be communicated and documented to the relevant personnel through relevant environmental training.

10. References

Department of Conservation and Land Management (CALM) 2003, *Phythophthora cinnamomi* and disease caused by it, Volume I – Management Guidelines.

Department of Environment and Conservation (DEC) 2006, Slender Andersonia (*Andersonia gracilis*) Interim Recovery Plan 2006-2011. Interim Recovery Plan No. 228. Department of Environment and Conservation, Western Australia.

Department of Environment and Conservation (DEC) 2008, Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan, Department of Environment and Conservation, Western Australia.

Department of Environment and Conservation (DEC) 2009, Wavy-leaved Smokebush (*Conospermum undulatum*) Recovery Plan, Commonwealth Department of the Environment, Water, Heritage and the Arts, Canberra.

Department of Parks and Wildlife (DPaW) 2013, Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan, Department of Parks and Wildlife, Perth, Western Australia.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012, Environment Protection and Biodiversity Act 1999 referral guidelines for three threatened black cockatoo species: Carnaby's Black Cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's Black Cockatoo (vulnerable) *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo (vulnerable) *Calyptorhynchus banksia naso*, Australian Government Canberra.

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2008, Approved Conservation Advice for *Dryandra mimica* (Summer Honeypot), Canberra, Department of the Environment, Water, Heritage and the Arts.

Department of the Environment, Water, Heritage and the Arts (DEWHA) 2009, Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo), Department of the Environment, Water, Heritage and the Arts.

Environmental Protection Authority (EPA) 2016a, Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment, Perth, Environmental Protection Authority.

Environmental Protection Authority (EPA) 2016b, Technical Guidance – Sampling methods for terrestrial vertebrate fauna, Perth, Environmental Protection Authority.

Johnstone RE, Kirkby T and Sarti K 2017, The distribution, status movements and diet of the Forest red-tailed Black Cockatoo in the South-West with emphasis on the Greater Perth Region, Western Australia, The Western Australian Naturalist, Vol. 30 No. 4.

Johnstone RE, Kirkby T, and Sarti K 2013, The breeding biology of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia, I. Characteristics of nest trees and nest hollows, Pacific Conservation Biology 19, 121-142.

Threatened Species Scientific Community (TSSC) 2016, Environmental Protection and Biodiversity Conservation Act 1999 Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain Ecological Community, Department of the Environment and Energy, Canberra.

Appendices

Appendix A – Figures and Baseline Data

Paper Size ISO A3

0 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

0

GHD

Main Roads
Tonkin Grade Separated Interchanges

Proposal location and Development Envelope

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 1

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Print date: 28 Oct 2020 - 15:11

Data source: Landgate_Subscription_Imagery\WANow Landgate / SLIP. Created by: bmorgan

Patch 1

Patch 2

Patch 3

Patch 4

Patch 5

Legend

- Major Road
- Minor Road
- Track
- Development Envelope
- Survey Area
- *Banksia* Woodlands of the Swan Coastal Plain TEC

BWSCP TEC Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

N

GHD

Main Roads
Tonkin Grade Separated Interchanges

Banksia Woodlands of the Swan Coastal Plain TEC

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 2

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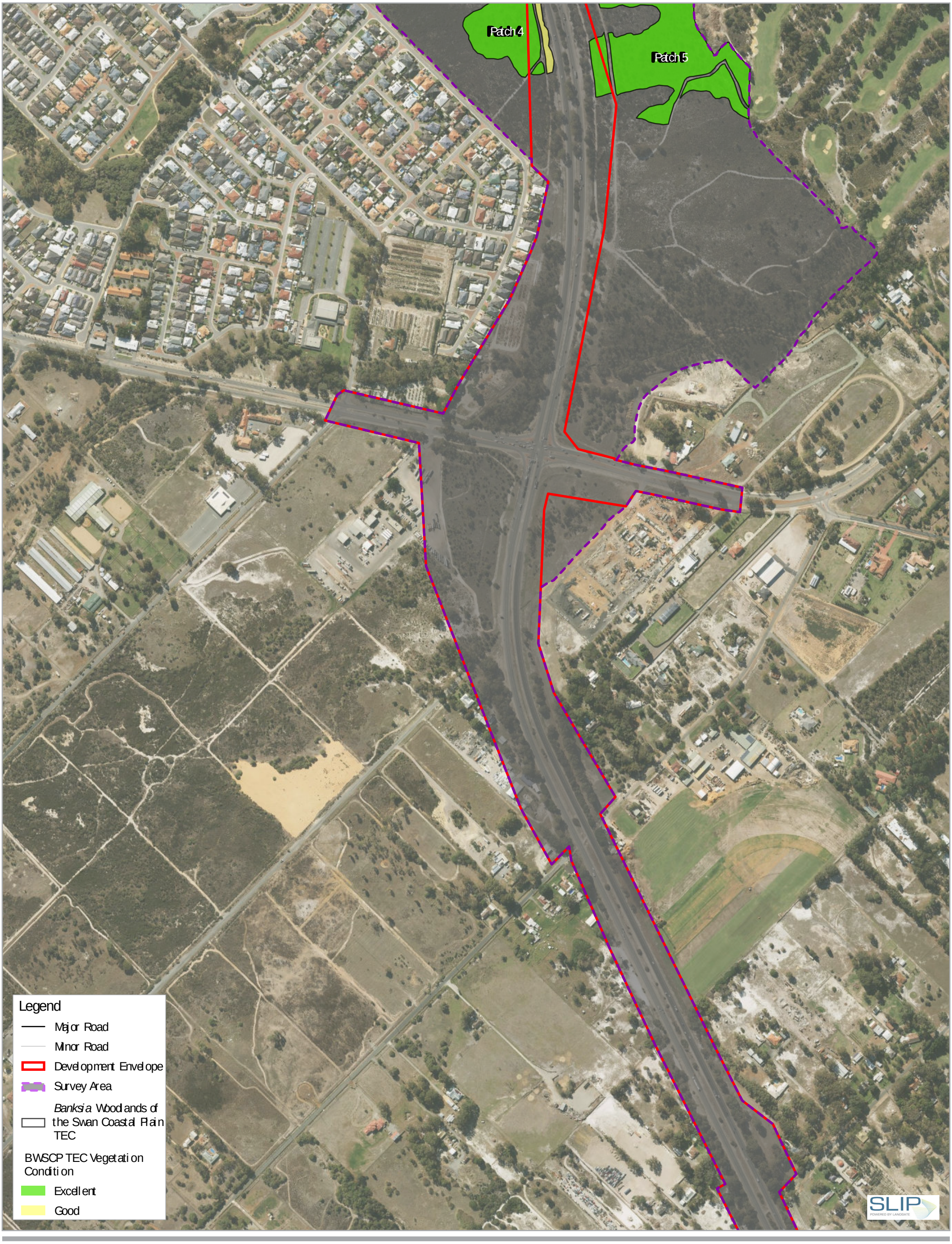

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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GHD

Main Roads
Tonkin Grade Separated Interchanges

Banksia Woodlands of the Swan Coastal Plain TEC

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 2

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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GHD

Main Roads
Tonkin Grade Separated Interchanges

Banksia Woodlands of the Swan Coastal Plain TEC

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 2

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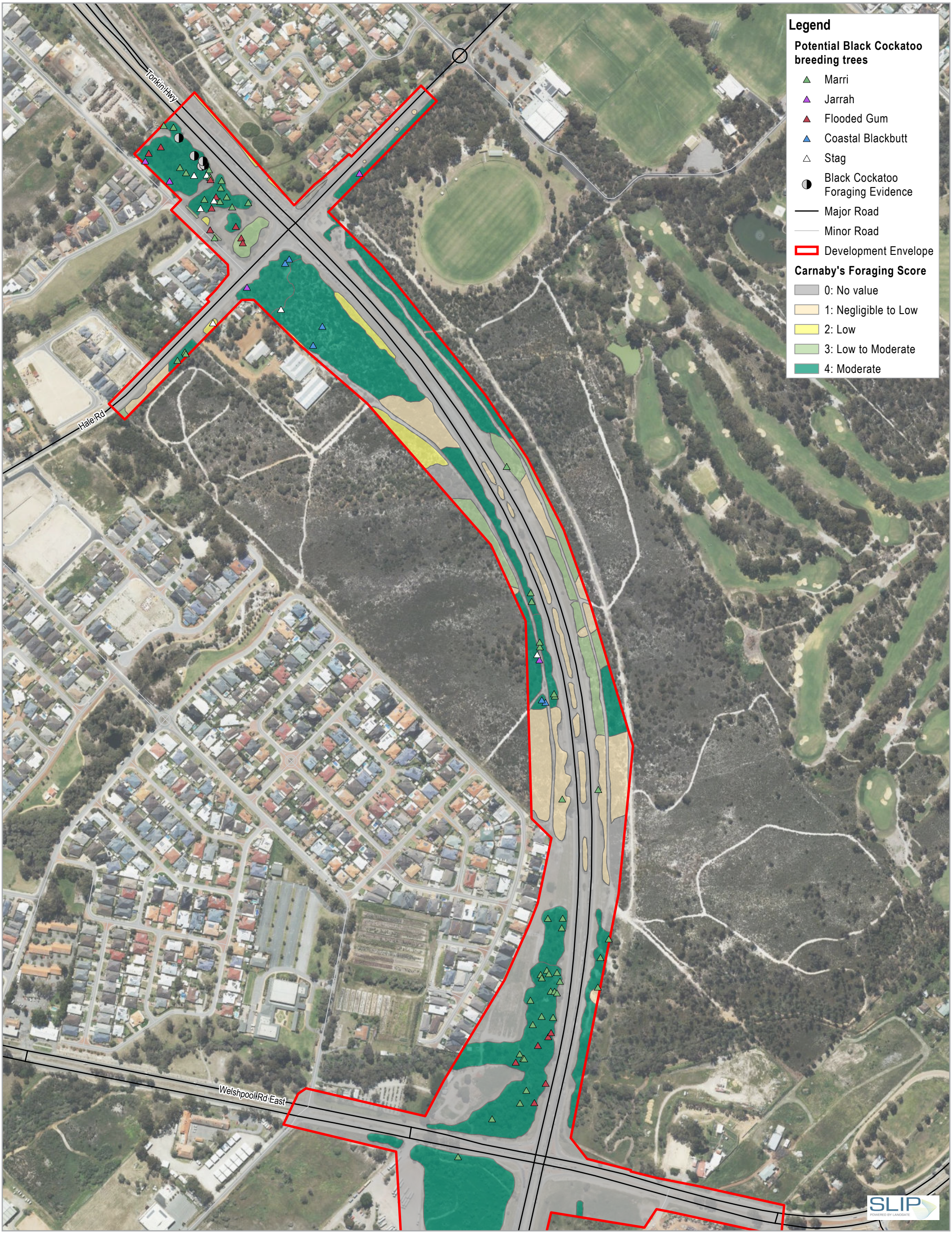

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

Main Roads
Tonkin Grade Separated Interchanges

Carnaby's Cockatoo Foraging and Breeding Habitat

Project No. **12523571**
Revision No. **0**
Date **2/19/2021**

FIGURE 3

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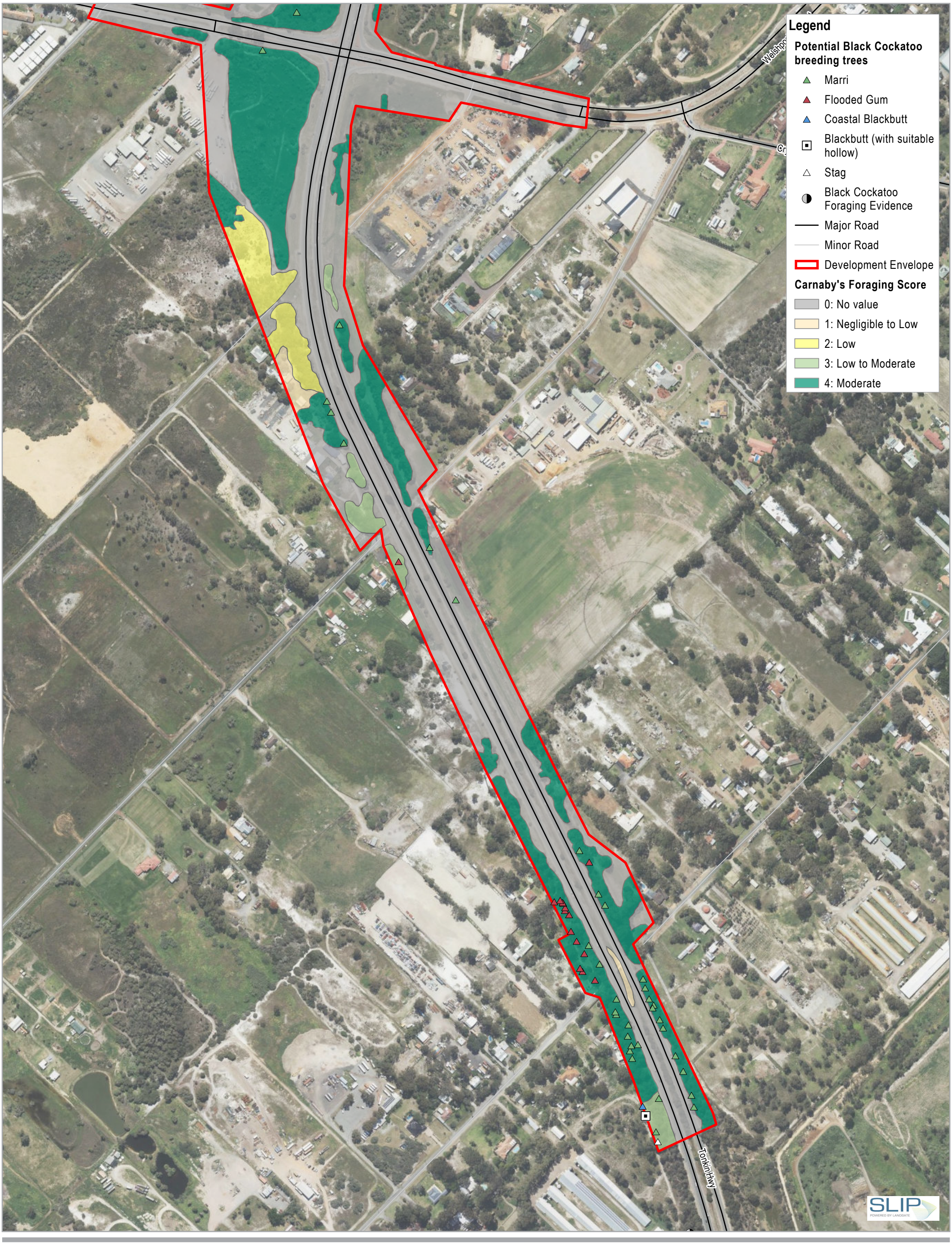

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Grid: GDA 1994 MGA Zone 50

N

GHD

Main Roads
Tonkin Grade Separated Interchanges

Carnaby's Cockatoo Foraging and Breeding Habitat

Project No. **12523571**
Revision No. **0**
Date **2/19/2021**

FIGURE 3

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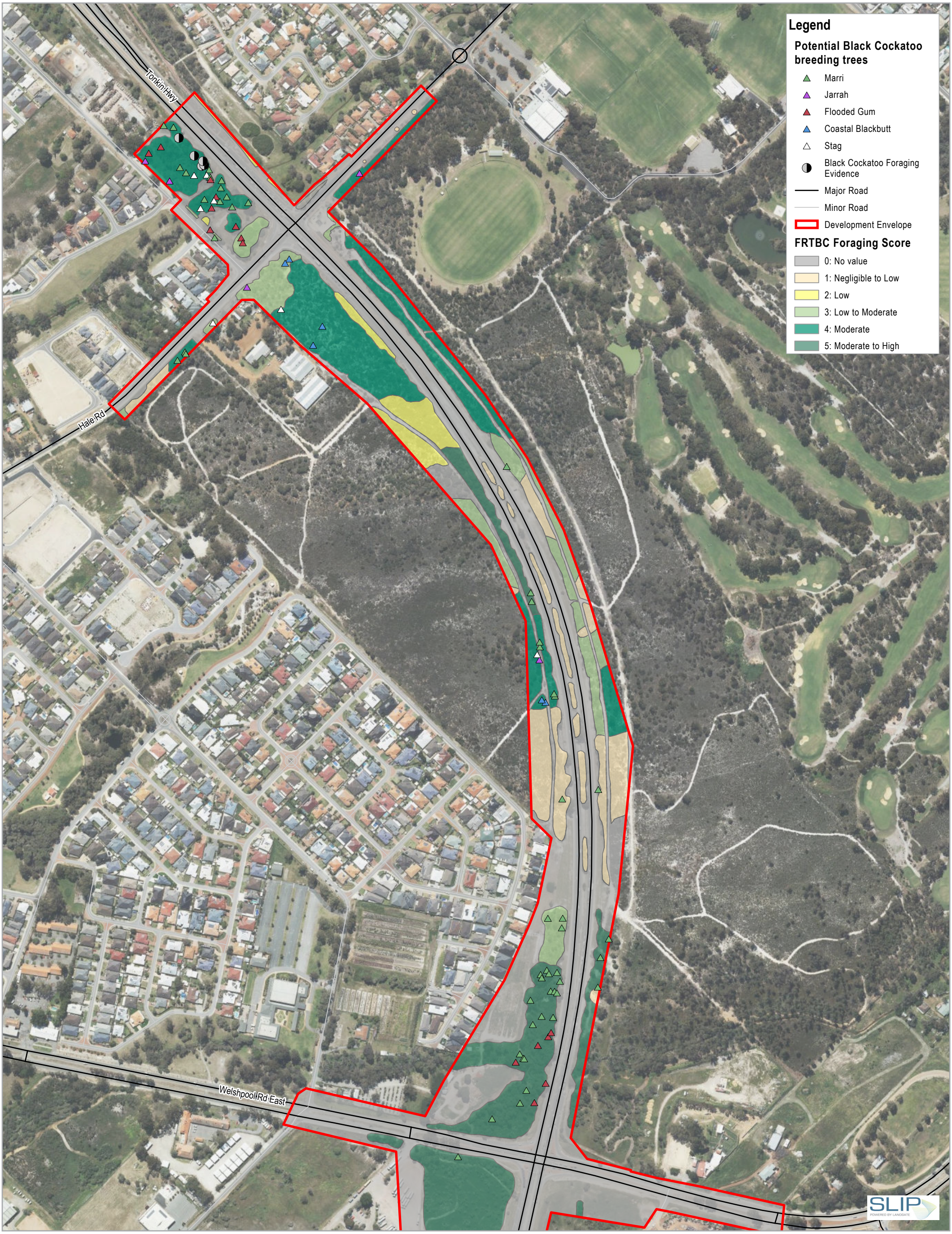

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Grid: GDA 1994 MGA Zone 50

GHD

Main Roads
Tonkin Grade Separated Interchanges

Forest Red-tailed Black Cockatoo Foraging and Breeding Habitat

Project No. **12523571**
Revision No. **0**
Date **2/19/2021**

FIGURE 4

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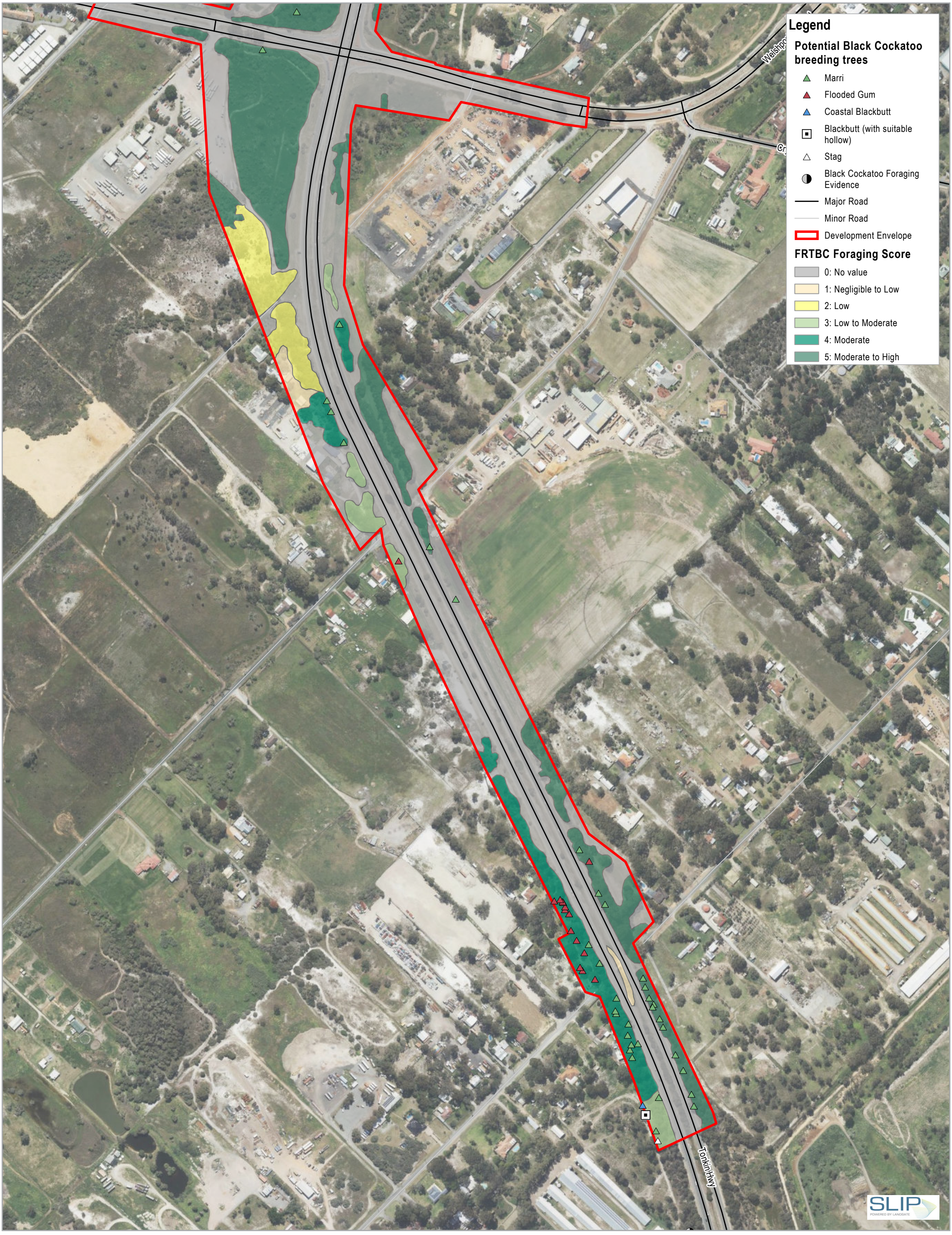

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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GHD

Main Roads
Tonkin Grade Separated Interchanges

Forest Red-tailed Black Cockatoo Foraging and Breeding Habitat

Project No. **12523571**
Revision No. **0**
Date **2/19/2021**

FIGURE 4

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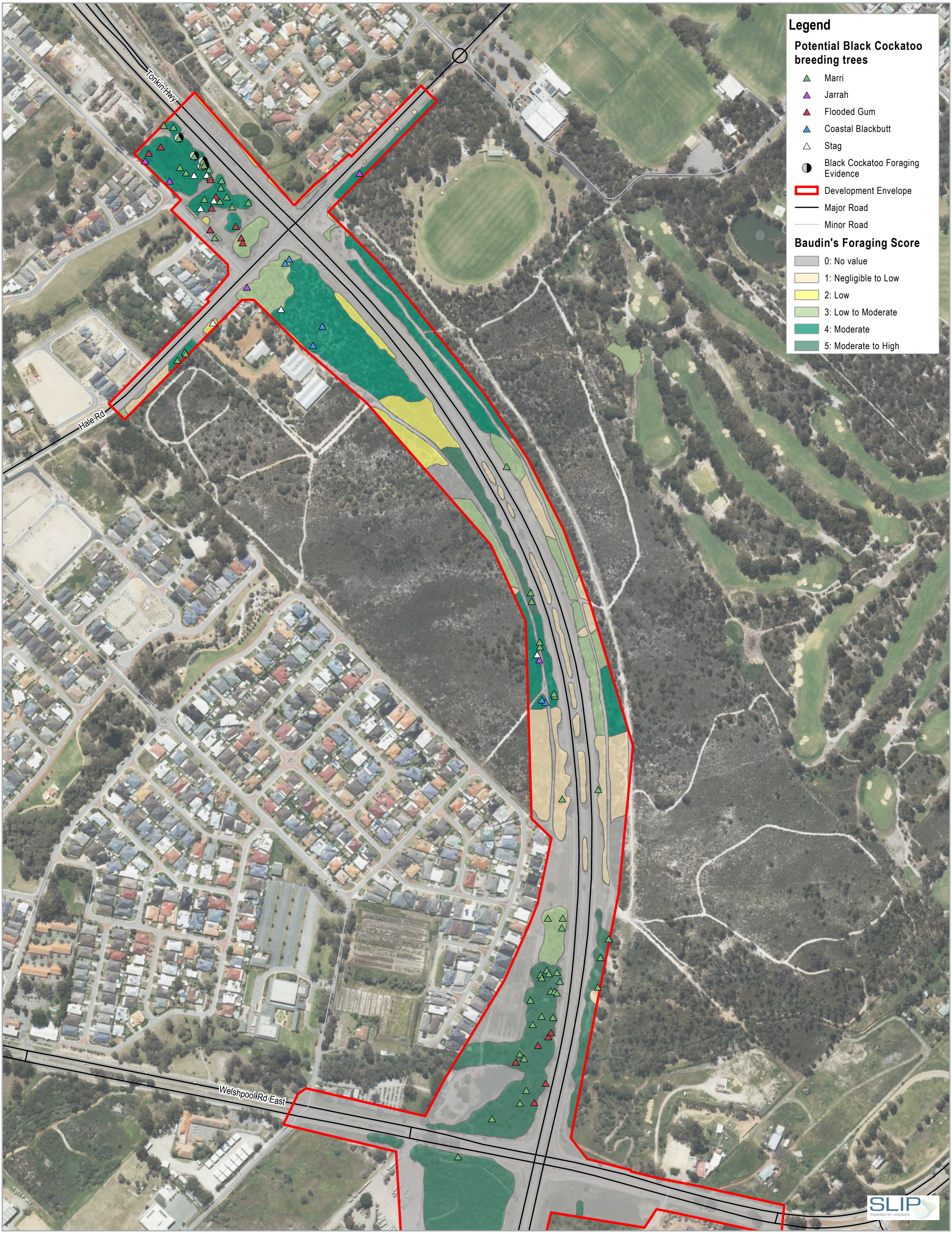

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Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

Main Roads
Tonkin Grade Separated Interchanges

Baudins Black Cockatoo Foraging and Breeding Habitat

Project No. **12523571**
Revision No. **0**
Date **2/19/2021**

FIGURE 5

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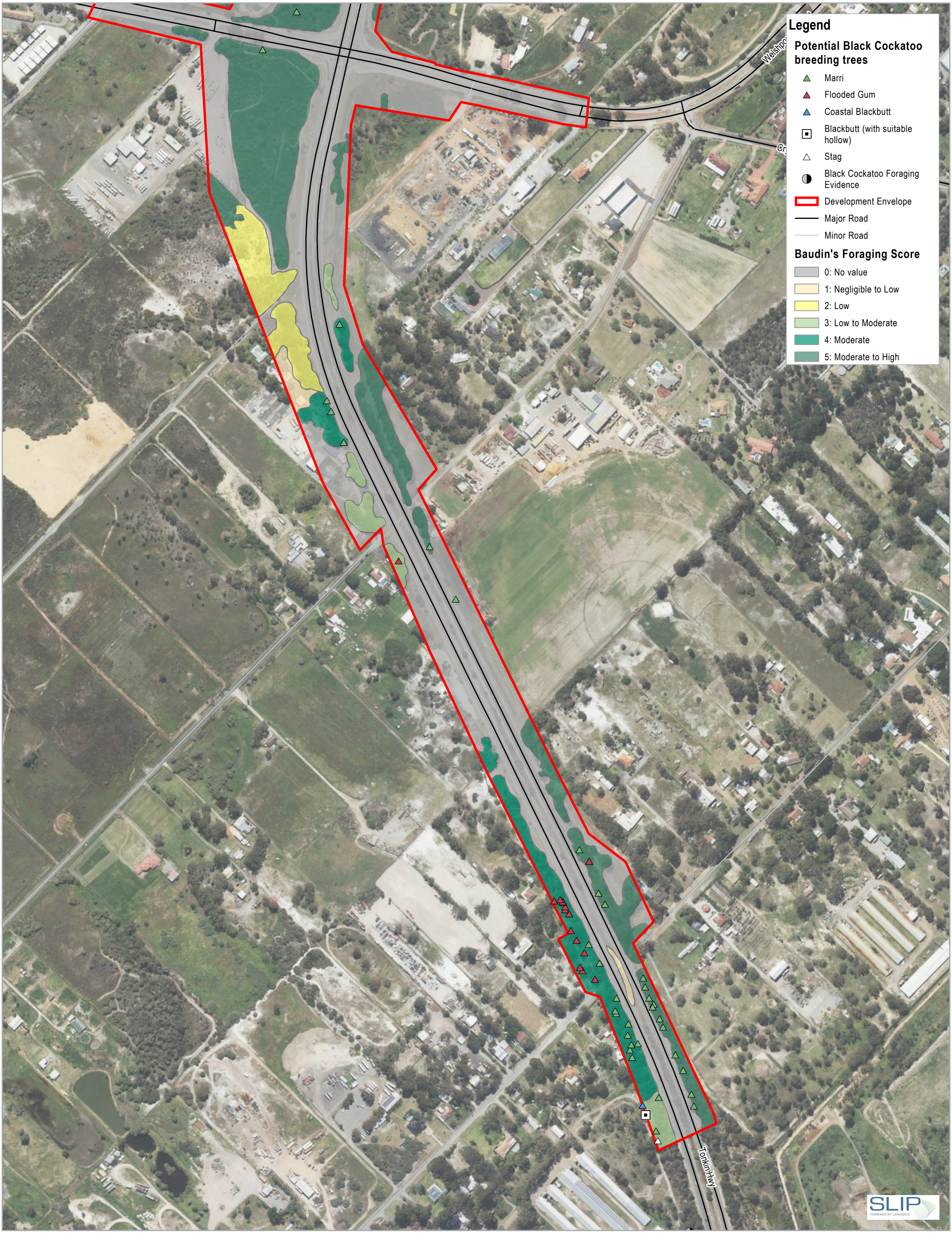

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GHD

Main Roads
Tonkin Grade Separated Interchanges

Baudins Black Cockatoo Foraging and Breeding Habitat

Project No. **12523571**
Revision No. **0**
Date **2/19/2021**

FIGURE 5

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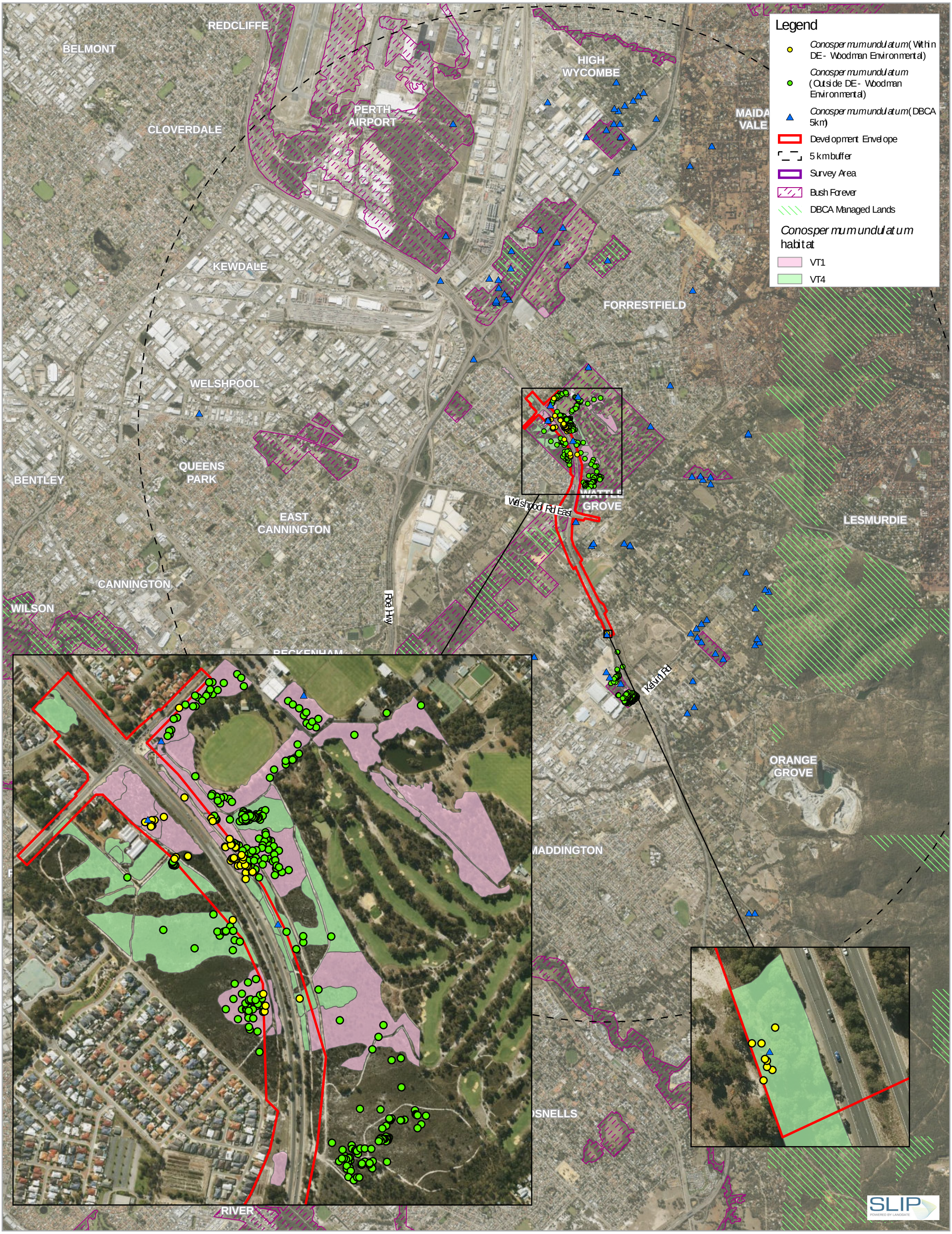

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

Main Roads
Tonkin Grade Separated Interchanges

Wavy-leaved Smokebush (*Conosper mum undulatum*) - Habitat and Local Context

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 6

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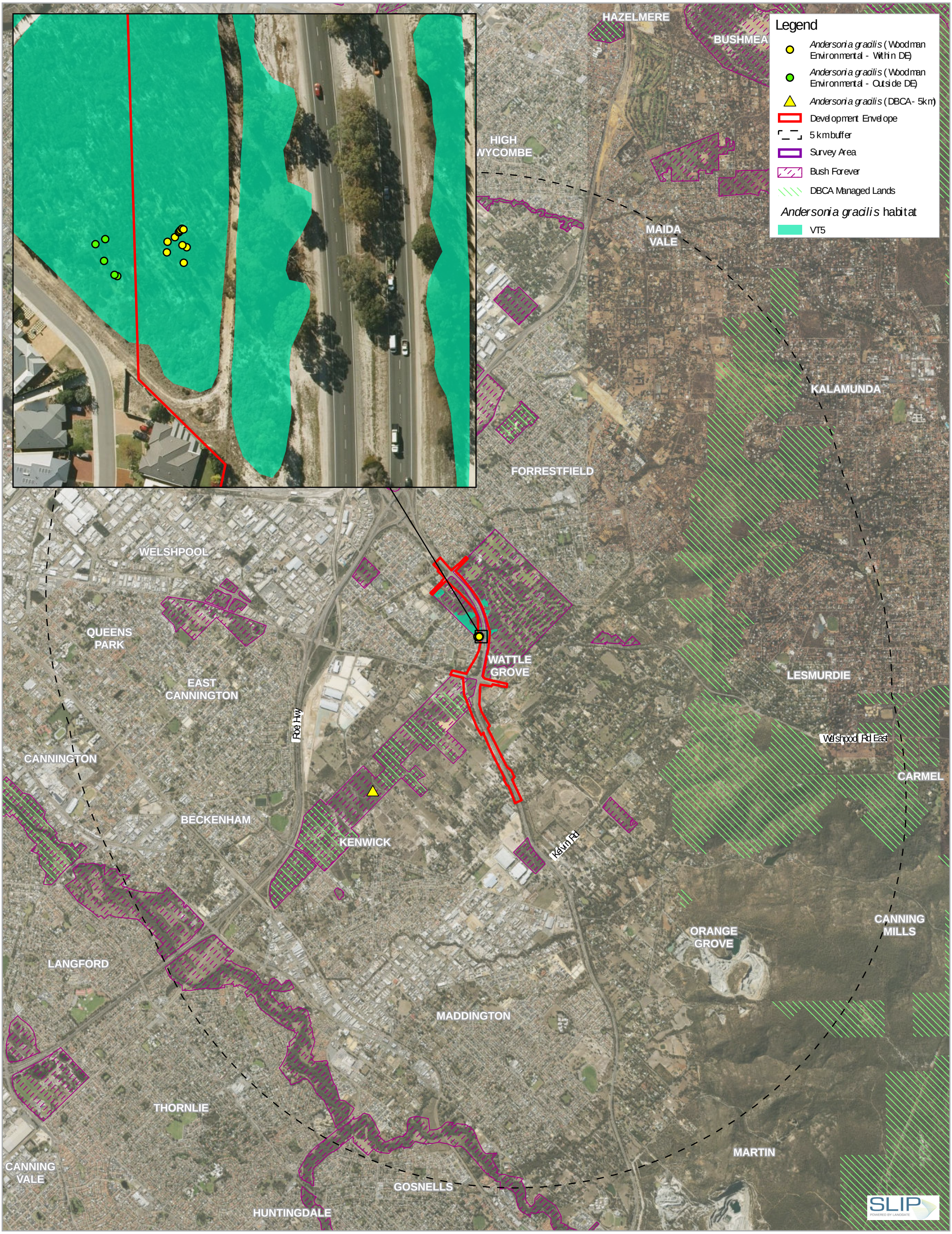

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Kilometres

Map Projection: Transverse Mercator
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Main Roads
Tonkin Grade Separated Interchanges

Slender Andersonia
(*Andersonia gracilis*)
- Habitat and Local Context

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 7

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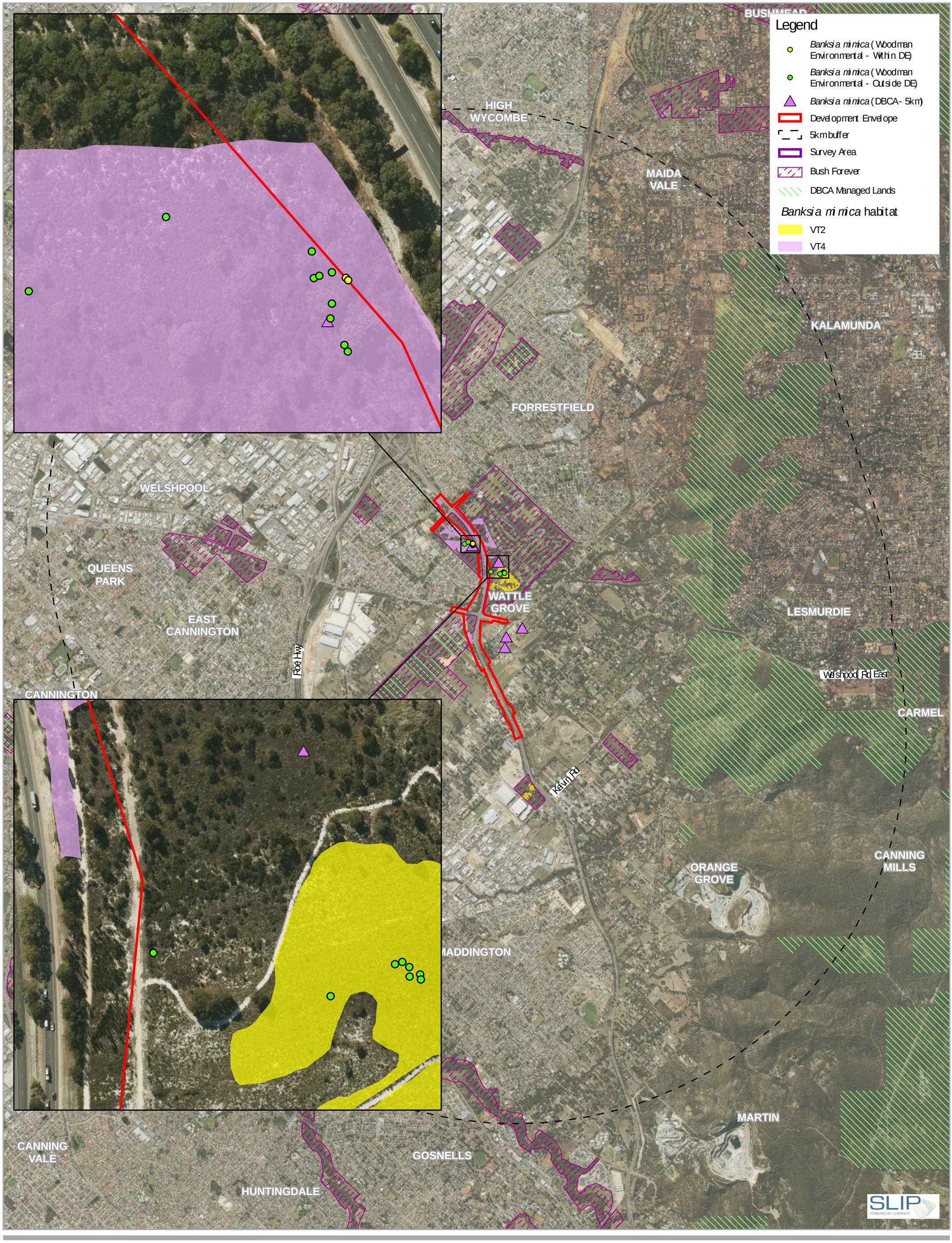

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Kilometres

Map Projection: Transverse Mercator
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Grid: GDA 1994 MGA Zone 50

Main Roads
Tonkin Grade Separated Interchanges

Summer Honeypot (*Banksia mimica*) - Habitat and Local Context

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 8

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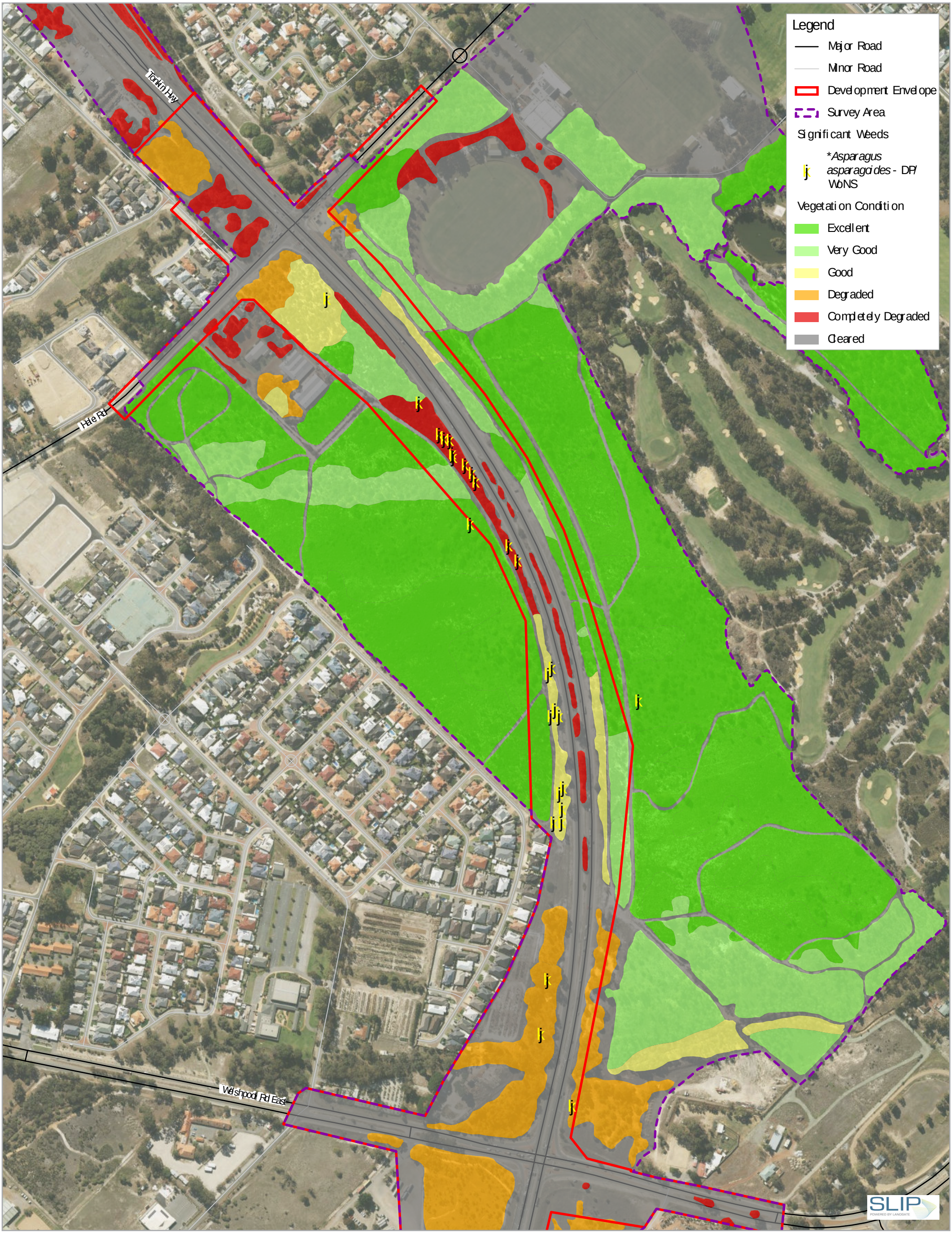

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Metres

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Main Roads
Tonkin Grade Separated Interchanges

Significant Weeds

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 9

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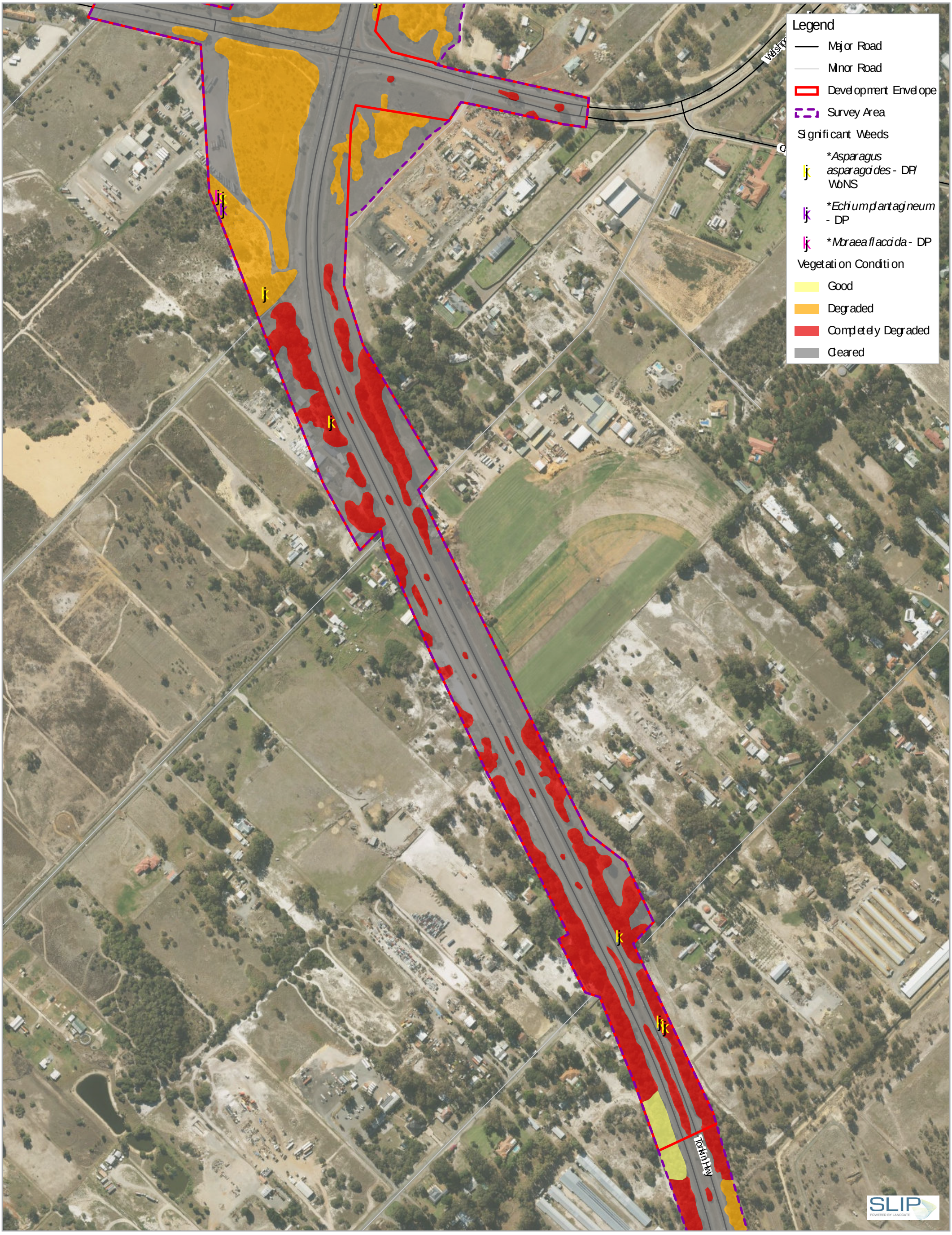

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Metres

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Main Roads
Tonkin Grade Separated Interchanges

Significant Weeds

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 9

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Main Roads
Tonkin Grade Separated Interchanges

Phytophtora Dieback Occurrence

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 10

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Legend
Major Road
Minor Road
Development Envelope
Phytophthora occurrence
Excluded

Crystal Brook Rd

Tonkin Hwy

SLIP
POWERED BY LANDGATE

Paper Size ISO A3
0 50 100 150 200
Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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GHD

Main Roads
Tonkin Grade Separated Interchanges

Phytophtora Dieback Occurrence

Project No. 12523571
Revision No. 0
Date 28/10/2020

FIGURE 10

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Data source: Landgate_Subscription_Imagery\ WANow Landgate / SLIP, Roads - 2020, Woodman Vegetation mapping, Significant Weeds - 2020. Created by: bmorgan

GHD

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12523571-8325-7/https://projectsportal.ghd.com/sites/pp18_03/sr282tonkingradesepa/ProjectDocs/12523571-REP-EPBC-Action Management Plan.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	H Morgan	D Farrar		D Farrar		18/09/2020
B	H Morgan	D Farrar		D Farrar		30/09/2020
0	H Morgan	D Farrar		D Farrar		30/10/2020
1	H Morgan	D Farrar		D Farrar		19/02/2021

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